AUGUST 1960 3/6

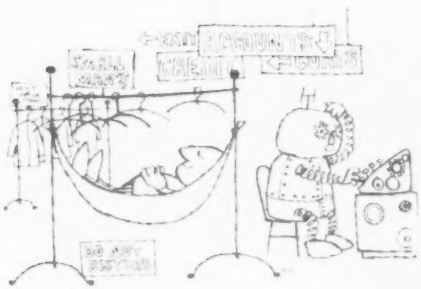
# AUTOMATIC DATA PROCESSING

JOURNAL OF MANAGEMENT AND INFORMATION SYSTEMS

*Data transmission by Microwave*

*How to use service bureaux*

*On the way—new alternative to MICR*



*'Tailor of Taste' automates credit accounting*

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# Paragon A.D.P.

Since 1886 Paragon have pioneered the integration of original data recording.

In the Retail field Paragon Check Books provide the most efficient and comprehensive source of documentation whilst Paragon experience in modern, high speed data processing enables A.D.P. executives to use Paragon precision printed continuous forms with confidence in all electric and electronic Output Units.

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# AUTOMATIC DATA PROCESSING

VOL 2 No 8 CONTENTS AUGUST 1960

JOURNAL OF MANAGEMENT AND INFORMATION SYSTEMS



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**AUTOMATIC DATA PROCESSING**

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# Your A.D.P. report is not complete — unless it covers the

# AEI 1010

DATA PROCESSING SYSTEM

This system has an unequalled combination of flexibility, speed, reliability and low cost. It has been developed and built by Associated Electrical Industries whose systems and programming teams are on call for co-operation at all stages from feasibility studies to installation.

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**COMPACTNESS** *Fully transistorised. A typical medium-sized installation occupies only 500 sq. ft.*

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AEI

**Associated Electrical Industries Limited**
**Electronic Apparatus Division**
**Computer Sales**
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# *The Trend*

THANKS to the pundits, the books, lectures, courses and (if we may say it) magazines and of course the indefatigable salesmen, the idea of automatic data processing has won through. What began as a small pack of snow no bigger than a man's fist has now been rolled into quite a sizeable snowball. Admittedly, a lot of managements have still plenty of homework to do on ideas that are bandied around with nonchalance by a few: ideas—or possibly better, techniques—for providing management with *information* (but we mustn't be beastly to the Philistines and we have already had our say on 'information systems'). We can settle for the fact that the trend is set fair for a lot more automatic data processing—whether it be sophisticated or not.

With the example and experience of the pioneers, with news of fresh orders reaching us almost every week and with the manufacturers putting out not only better machines, but a more complete range of equipment, it isn't an overstatement to surmise that one day the universal business machine will be as commonplace as the office duplicator.

But let's take one thing at a time and start with example and experience. Everybody loves a bandwagon bound for the lush pastures of lower clerical costs, integrated systems and better control—in short the salesman's brief; and by and large those that have bought the salesman's story have *seen the possibilities*. We don't say they have reached the pastures, but they've had a whiff of them.

The fresh orders pouring in? Some were suspicious at first, some took a long time to probe and make up their minds, and some thought the right equipment was still to come along. The phenomenal success—and we use the words with care—that two manufacturers have had with new systems within the last few months underlines that quite a number were waiting for the right machine.

And this brings us to equipment. So far, we can say that we have been talking mostly about *big* concerns: it is the Courtaulds, Wills and Boots that show up as tiny flags on the computer sales managers' maps. But now the range of equipment has become much wider than it was two years ago, and so a lot more executives in medium-sized firms will be listening to the man with the briefcase and glossy brochures intoning about production control, sales analysis and forward planning, and possibly also about more down-to-earth matters such as 'the simultaneous elimination of errors' and card-punching clerks.

Automatic data processing does not begin or end with the computer—in some cases, the computer is even expendable. At one end it is concerned with 'source data' and putting these into a form suitable for processing, and at the other end it is concerned with the results. Between the two poles a great variety of equipment can be used, and during the past few weeks we have been collecting details on every item of equipment known. The results of this endeavour will be published in the form of a survey, the first instalment of which will feature in the September issue.

Like the early traders among the natives, we will spread the goods out for display, and we hope that this glutted shop window will be of some avail to those for the first time on the threshold of automation.

# THREE SERVICES HAT-TRICK FOR

# EMIDEC

## COMPUTERS

With the placing of an order for an all-transistor EMIDEC 1100 computer for the Admiralty, E.M.I. Electronics Ltd. has achieved a notable hat-trick. EMIDEC electronic data processing systems will now serve all three services – Navy, Army and Air Force.

The Senior Service will use their EMIDEC 1100, capable of half a million calculations a minute, to deal with a 90,000 item stock control problem at the R.N. Stores Depot in Wiltshire. The Air Force EMIDEC will calculate the payrolls of 80,000 civilian employees, and the R.A.O.C. will use a large EMIDEC 2400 to maintain all its MT spares throughout the world.

**EMIDEC machines are the first of a new era of computers employing solid state physics. They are not adaptations of existing scientific instruments, but the first computers in this country designed from the word go to cope with full scale business operations. They are now in full production, and regular deliveries are being made all over Britain.**

All EMIDEC computers have the expert backing of E.M.I.'s Service and Maintenance organisations.

*Control console of EMIDEC 1100*

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EE 108A

◀ Photo: at the Harrogate Conference (see report on page 20)

# Computer in Suburbia

*Luring people to buy*

RECENTLY, AEI—following well-established precedents—opened a computer demonstration centre in Sale, Cheshire.

Established for the use of future customers of the company's 1010 computing system, the centre consists of a three-storey converted Victorian suburban house, situated in a quiet tree-lined avenue some fifteen minutes distant from Manchester. The ground floor of the building is the demonstration room where the 1010 and its peripheral equipment are located, as well as a 950 computer, which AEI designed from scratch some five years ago, and on which much of the pioneer work for the 1010 was done.

The compactness of the AEI 1010 is quickly revealed by visual comparison with the 950. The nucleus of the system—control and arithmetic circuits, data scanning equipment, ferrite core store, and the control desk—takes up no more space than two medium sized filing cabinets, a total area of 6¼ feet by 2½ feet. In fact, it would be possible to house the computing nucleus, and sufficient peripheral equipment to carry out two independent programs in parallel (the complement of equipment in the computer centre) in the average executive's office. This compactness has, of course, been achieved by intensive miniaturisation of all components.

Above the demonstration room, on the first floor, is the lecture room which will be used for programming courses. From the size of the room it seems not more than six or seven people will attend these courses at any one time. Above the lecture room are the small rooms set aside for visiting programmers—the so-called 'quiet rooms' where test runs can be prepared, programs debugged, and files converted to the computer media.

Although primarily set up as a promotion exhibit to lure people to buy, the centre will do the job 'in depth' by providing training and advisory facilities.

AEI designed the 1010 for integrated data processing by stealth, with the possibility of linking up to 32 peripheral units to the data highways, one by one as the need arises. This provides the opportunity to start small and grow big. One order—from AEI themselves—has been obtained for the 1010, and from the air of muted expectancy and general canniness encountered at the centre recently it seems a number of orders are pending.

## New Elliott machine

*Ultra-high speed Switching*

THE first news is filtering through of the new Elliott 503, the first of Elliott-Automation's computers to utilise ultra-high speed switching. E-A say that this technique marks the beginning of a new generation of computers, whose unit cost of work will be a fraction of that incurred on existing computer installations.

Certainly, by any standards, a switching speed of five millimicroseconds is fast; the company asserts that calculations are carried out a thousand times faster than on existing computers. An enormous work capacity will be thereby credited which will be met by extensive time sharing, and by using parallel programs. The 503 will incorporate new high-speed magnetic storage units giving unlimited extension of storage facilities, and multiple input and output channels. Special keyboards will facilitate parallel programming and a full range of automatic programming routines including internationally agreed autocoding systems will be available. [The 503 is an E-A development, and is not the machine developed by National Cash, which E-A are to build, which was referred to in these notes last month.]

## Life calculations

*Yorkshire Insurance take the plunge*

LATEST of the insurance companies to sign up for a computer, the Yorkshire Insurance Co Ltd intend to use a 1401 when it is delivered to extend their present mechanised set-up. In both their 'Life' and 'Non Life' departments the machine will facilitate the preparation of statistics as well as renewal notices. Life calculations and other actuarial work will also be put onto the machine.

## Radio teleprinting

*. . . and cutting out some*

AN airline communications teleprinter system which automatically locks out offices not covered by the messages' calling code, and brings them back automatically into line when the message is over, has recently been inaugurated in Barbados, West Indies. The system, which will cover the ten islands in the Caribbean, from St Kitts to

Trinidad, works on the principle of the telephone party-line.

The message is code-punched into paper tape and fed into a tape-reader which translates the code and sends telegraphic signals to the 25 offices in the group. A special two-letter calling code specific to each office required precedes the message. The teleprinters at the receiving offices respond to their individual calling codes, and automatically condition themselves to receive the message. The teleprinters not concerned automatically lock themselves out of circuit and indicator lights warn that the circuit is busy; when a message is transmitted the circuit is automatically freed and the indicator lights signal that circuit is free.

The system, the Caribbean Eastern Island Aeronautical V H F Communications System, provides integrated radio-telegraph facilities for airlines operating in the area. International Aeradio Caribbean Ltd who operate the network, claim it is the world's largest inter-island radio communications system. Creed engineered the telegraph part of the system, and Creed 75 teleprinters, operated either manually or by automatic transmission, are used throughout the network.

## Exporting combine

*Automatic Post Offices for sale*

IN order to offer an integrated range of automatic mail handling equipment to overseas countries, engineering and allied firms have combined themselves into a manufacturing consortium, under the title of the Manufacturers of British Postal Equipment. This arrangement was first brought into effect in July of this year, when the members of the industry held an exhibition of British postal mechanisation to coincide with the Universal Postal Union Conference at Eastbourne. From the exhibition and from the combined brochure mailed to every postal administration in the world, a number of orders have been received, from Russia, Switzerland, Egypt, and others and the success of this may well mean that the association will continue in the future though with no formal ties. Among companies involved are Elliott Brothers Ltd and Associated Automation, Vickers-Armstrong, Sovex, Thrissell Engineering, Setright Registers, Harrison & Sons, and Waterlow & Sons.

## Globe-trotter returns

*Prospecting for Leo*

HOME after a ten-week lightning tour of South Africa and Australia is T R Thompson, General Manager of Leo Computers. He has been in Johannesburg for discussions on the Computer Centre which Leo and the Rand Corporation are setting up jointly [see 'Data Digest' July] and took the opportunity to assess the market potential of the big industrial centres of Vereeniging and Pretoria as well as Johannesburg. From there he flew on to Australia in order to put in hand negotiations for computer centres in Melbourne and Sydney.

'There is a tremendous interest

Thompson

*audiences were enthusiastic*

in computers in these countries,' he said. 'It's been forced on them by the acute shortage of clerks, but they really do understand the importance of the automatic office and the problems involved. I was at the second Computer Congress in Sydney—and there were no less than 700 delegates there! It was the same in Johannesburg—200 at the Computer Society — and wherever I addressed meetings — and in all I must have spoken a dozen times in the two countries— I found the audiences tremendously enthusiastic and very well-informed, too!'

Mr Thompson estimates that there is a potential in Australia for at least 50 Leos to be bought separately or jointly by big firms, about 20 in South Africa, and immeasurably greater demand for 'launderette' or the time-hiring by smaller firms.

## OR Know-how

*Opportunities for graduates*

GRADUATES with a good science or mathematics degree are to be invited by the British Iron and Steel Research Association to study for a diploma in Operational Research, under a new graduate apprenticeship scheme.

BISRA say that apprentices will become members of teams engaged on actual research in the steel industry. In this way, they will not only learn specialist techniques, but also their practical application to real industrial problems. The graduates will eventually sit for the diploma in Operational Research which the London School of Economics has recently instituted. The scheme is sponsored by BISRA's Operational Research department in conjunction with the LSE.

The Association will regard graduate apprentices under the scheme as temporary members, and will pay them £700 per annum, with an extra £25 for every year above 21. But will this be adequate to attract the men whom they want, and to justify a scientist going 'back to school' for two years? The response to the appeal will be watched with interest.

## Stretch for atoms

*First giant signed up*

THE UK. Atomic Energy Authority has signed a contract for a 'Stretch' computer. This computer will supplement the IBM 709 which is at present working in Aldermaston and will be installed

there in about September 1961.

This is the first contract for a Stretch class system in this country, though this machine has been installed in the United States.

Currently, IBM are guarding details of Stretch very jealously but this much they do reveal about the Authority's machine: it has random access disc storage units, capable of transferring one word every eight microseconds; six magnetic core storage units, which have a retrieval time of 2.18 millionths of a second; and a very large magnetic tape backing store.

Stretch will cover about the same floor area as the 709, but is 75 to 100 times more powerful. It will be able to complete 100 thousand million arithmetic operations per second. IBM claim that the Stretch system is the most powerful and versatile system in the world. Over to you, Remington and Ferranti!

## Airborne venture

*On beam by computer*

A NEW company, Teldix, has been formed in Germany to handle research, manufacture, service and sale of aircraft systems and navigational units. This company is jointly sponsored by the Bendix Corporation of America and the Telefunken GmbH of Germany, and the joint-managing directors are James B Treacy of the Eclipse-Pioneer Division of Bendix, and Fritz Krumling of Telefunken.

Among other equipment to be manufactured are airborne flight control equipment and navigation instruments — including airborne computers. Teldix will be responsible for servicing and manufacturing airborne systems on the Lockheed F-104 and the Fiat G-91.

## Spook simulation

*It 'ghosts' space flights*

THE eight-engine booster of Saturn, the US space vehicle, will be flown thousands of times in the coming year—before it even reaches the launching pad. This will be done—at a fractional cost—by the IBM 7090 guided by an automatic monitoring system known as Spook (Supervisory program over other kinds). Spook consists of 50,000 instructions on a single reel of magnetic tape which enables the computer to recognise incoming data and select the job to be done at the appropriate time.

The use of the computer will enable scientists engaged on the project to see how their design modifications will affect an actual flight in space. The computer will also analyse vibration and heat transfer of the engine booster as it develops up to 36 million horsepower, and will enable the redividing of fuel supplies, made necessary by the failure of an engine, to be assessed at various stages of the flight.

It is estimated that this simulated flight on the computer will save 25 percent in machine costs, and will allow data to be analysed in three to four days, as compared with five to six weeks formerly. Most important of all, it will cut down the 'live' flights necessary before a final launching. The V 2 had to have 1,000 test firings. Thanks to Spook, Saturn will need only ten!


*Starting next month . . .*

**AUTOMATIC DATA PROCESSING**

**will begin to publish a comprehensive survey of ADP systems and equipment. This survey, which will run over several issues, will provide a very thorough buyer's guide not only to computers but also to the great deal of equipment associated with modern data processing. Part I — which will appear in the September issue — will cover**

***LARGE AND MEDIUM SIZED DIGITAL COMPUTERS***

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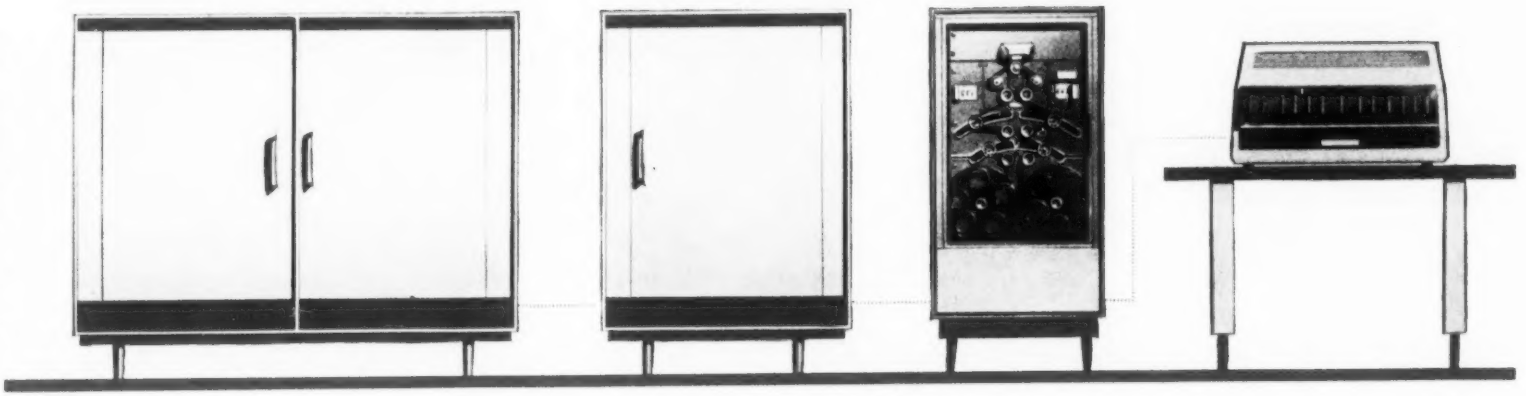
# 803*

Low Cost Automation of High-Volume Business Arithmetic, Technical Computing, Data Processing, Analysis and Management Reporting by National ELLIOTT



AUTOMATIC DATA PROCESSING

# THE ONLY CABINET-SIZE ELECTRONIC COMPUTING AND/OR DATA PROCESSING SYSTEM WITH A MAGNETIC CORE MEMORY OF 49,152 DECIMAL DIGIT CAPACITY PLUS HIGH-VOLUME, MAGNETIC-FILM MAIN DATA FILE

**(Each reel has a storage capacity equal to that of 60,000 80-column punched cards)**

This is precisely what business and technology have been waiting for: A thoroughly reliable system of electronic office automation (and/or technical computation) which can be easily installed at modest cost. So versatile that its applications are too diverse for concise enumeration, 803 is designed to serve as a highly efficient everyday 'tool' of business administration; and, in its twin role, as a new facility in the field of industrial research and product development.

Demonstrations—given by specialists in business and technical applications—can be arranged by addressing your requests as indicated below.

**Easy to Install**
No air-conditioning required. Powered by normal mains supply—anywhere. Plug in and switch on.

**Space Saving**
Dimensions of Computer/processor: 5'6" x 1'4" x 4'8": of Magnetic File Unit: 2'3" x 2'0" x 5'4".

**Easy to use**
3-switch control. Simplest-ever instruction code. Large ready-made library of programs and sub-routines.

**Inherently Reliable**
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**Easily Expanded**
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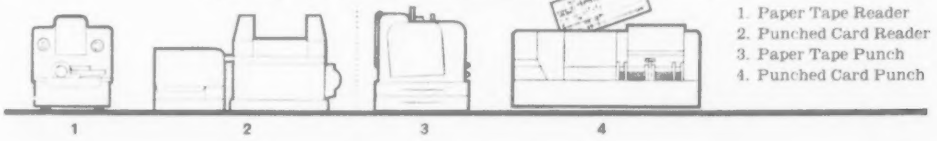
**FULL INPUT/OUTPUT FLEXIBILITY** *(Punched tape and/or punched cards)*



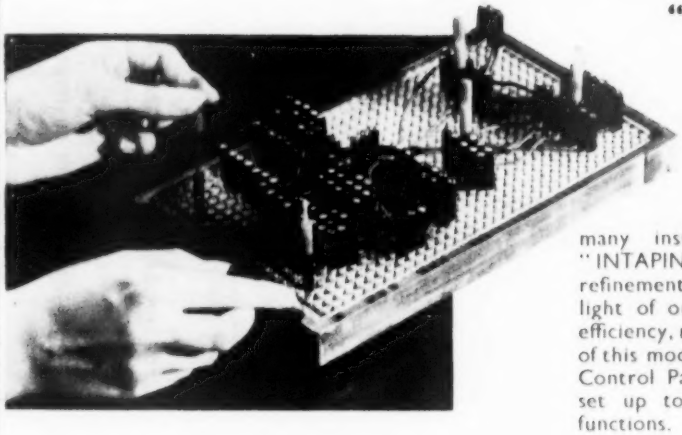

1. Paper Tape Reader
2. Punched Card Reader
3. Paper Tape Punch
4. Punched Card Punch

*Commercial enquiries & requests for demonstrations:* **N C R ELECTRONICS · 206 MARYLEBONE ROAD · LONDON NW1**

*Scientific enquiries should be addressed to:* **Computing Division · Elliott Brothers (London) Limited · Elstree Way · Borehamwood · Herts**

✲ **This is the First of a Series of Announcements Covering New Developments in NCR Computers**

# PUNCHED CARD USERS!



**"INTAPIN"—**

is the name we have given to our own range of Pre-Selective Plugboard Wiring Components. Whilst completely interchangeable with the fundamentally similar equipment introduced to many installations by our Company, "INTAPIN" incorporates modifications, refinements and additions designed in the light of our experience, to enhance the efficiency, reliability and, above all, *economy*, of this modern method, whereby one basic Control Panel can, in a few moments, be set up to perform alternative machine functions.

*"INTAPIN" is available to all Punched Card Users, and full details will gladly be provided on request.*

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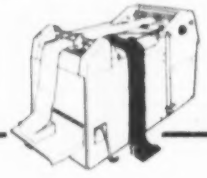
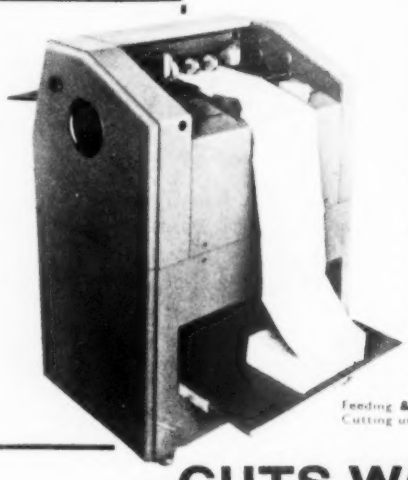
* The CARBON DE-LEAVING UNIT speedily de-leaves up to five carbons (a six-part set).

* The NEW IMPRINTING UNIT adds signature or other static information and can imprint a serial number and/or continuous vertical rules.





Feeding & Cutting unit

## new FANFOLD

## FIMAFOLD

**For Continuous form-users**

The Fanfold FIMAFOLD Continuous Form Guillotine cuts forms into units of pre-arranged depths and also removes sprocket holes. It takes less than a minute to adjust for varying depths with no complicated gear changing and can be set to give continuous or single cut operation, as desired. The machine is very robust and entirely mechanical in operation, requiring virtually no maintenance.

## CUTS WORK COSTS

**FANFOLD**

*FIMAFOLD guillotining for forms*

The Automatic Guillotine Imprinter and Carbon De-leaver can be grouped as one unit. Send for particulars now of these three aids to cutting work costs. Sizes: Forms up to 20½ in. wide and from ½ in. to 18 in. in depth in steps of ½ in. or ¼ in.

GLASGOW BIRMINGHAM MANCHESTER LEICESTER LEEDS CARDIFF BELFAST DUBLIN

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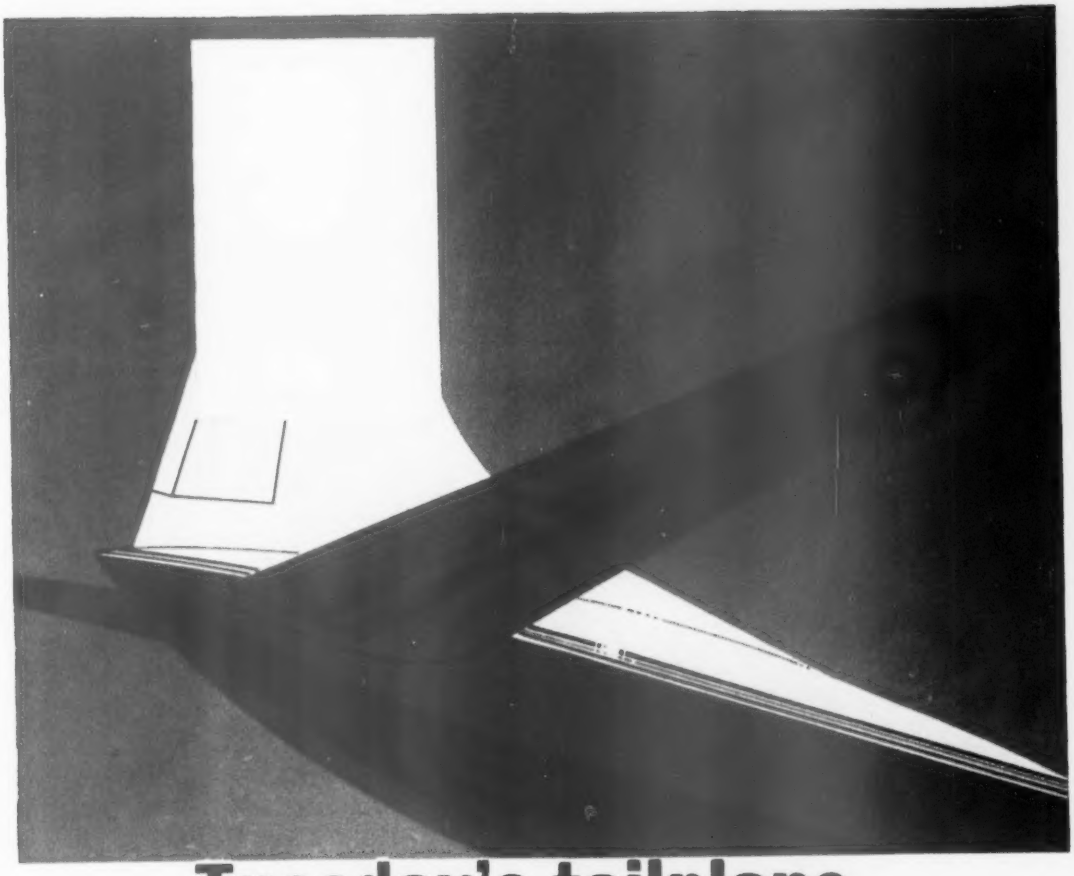
*Please send particulars of the Fanfold Fimafold Automatic Guillotine Imprinter and Carbon De-leaver to*

**NAME**

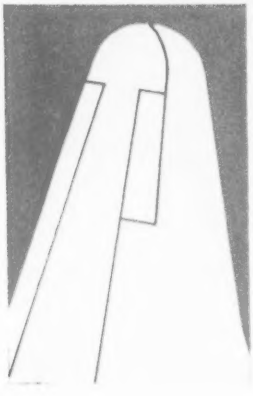
**ADDRESS**

ADP8

City Sales Office: 74-75 Watling St. London EC4 City 3781



# Tuesday's tailplane



There is no doubt that the tailplane will be there on Tuesday – or that every other part and sub-assembly will be available on the scheduled date.
• The Bradma Production Control System is the manufacturer's complete assurance.

It is suitable for every type of organisation – large or small – whether manufacturing turbo-jets or children's bicycles.
• The Bradma Production Control System means improved efficiency.

In every Industry, manufacturing delays are possibly the most serious and costly hazard likely to be encountered.
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Normal production efficiency is improved when delays and transcription errors in the preparation of factory documents are eliminated.
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There are simple hand-operated models for the smaller user, and electrically powered models incorporating many auxiliary devices for the larger user. The great advantage of the System is its adaptability. It can always be designed to solve your own particular problem.
• The Bradma Production Control System has all these features PLUS.

Bradma

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ADREMA LIMITED, 2-10 TELFORD WAY, LONDON, W.3

# *WEAR NOW —*

**A retail tailoring organisation use a computer exclusively to keep track of customers' credit accounts**

# PAY LATER

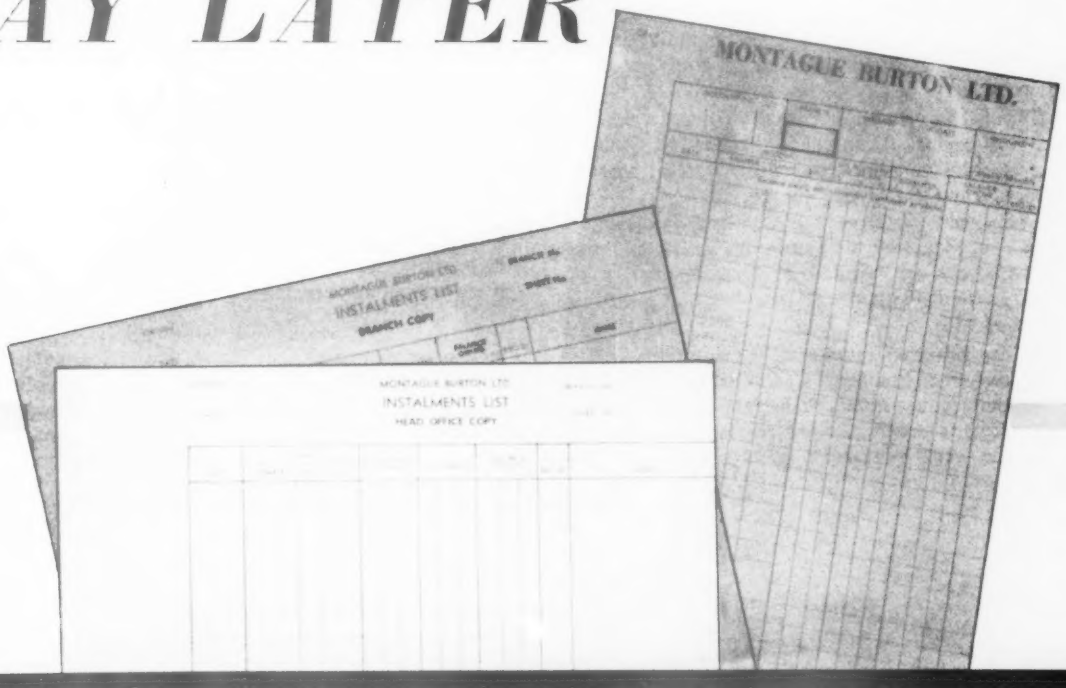
WITH 600 retail branches in Britain and Northern Ireland, 14 factories and about 25,000 people in their employ, Montague Burton are the largest tailoring concern in the world. They dress one man in five, and sell three times as many specifically tailored clothes as off-the-peg garments.

The chain of 600 branches is very much controlled from the company's Leeds headquarters, where in fact the largest factory is located. All orders come to Leeds—normally 'measurement forms' to which are appended lengths of cloth before being despatched either to the Leeds production areas or one of the factories. At any one time the company may be stocking 18-20,000 pieces of cloth, and the records for these are, of course, kept on punched cards. Burton have long been punched card users—their first installation dates back to 1929—and, in fact, they have two distinct punched card installations one of which is used to prepare a payroll of 13,000 employees covering six separate factories. However, the biggest punched card clerical effort is in keeping branch records—preparing stock lists (for stock auditors), etc. Recently, they have gone one stage further in the use of mechanised equipment.

Burton's business has been built up over the last 60 years on a cash basis, but towards the end of 1958 it was decided that the company would offer credit facilities in respect of both tailor-made and ready-to-wear garments. This facility was to be additional service to the customer and, as far as possible, tailored to his requirements; for example, repayments could be made either weekly or monthly, but in no way was the facility to detract from the established cash trade.

These facilities did begin on November 1, 1958, with a hastily devised handwritten system of recording accounts. It was, of course, clear from the start that a considerable amount of additional work would be involved and that a mechanised system would eventually be required. A number of machine manufacturers were contacted and subsequent investigations showed that a small computer could undertake the job and would give experience before extending further into the field of computers for all branch records. Consequently, Burtons ordered an ICT 1202 computer in March, 1959, and emphasised that an early delivery date was required.

The computer was delivered in November—eight months after the order was made—and a computer credit sales procedure is gradually taking on the work performed under the manual (handwritten) system. A credit account has a limited life—in Burton's case a garment bought on credit is normally paid off within 10 months—and so it is possible to vet old accounts through the manual system and put new accounts on to the computer. In this way the first system undergoes a sure, if lingering death and the computer procedure is not delayed by the takeover of existing accounts.




The documents used in the system: the instalment list and the branch copy, and the customer's credit card (right)

Burton's branches are organised in geographical areas, and at present eight areas have their accounts processed on the computer, and by the end of the year the accounts of the 500 branches should be dealt with in this way.

## The System

Burton's credit system works in this way: when a customer wants to buy a suit or coat on credit, providing the branch manager approves, he is asked to sign an agreement. He can choose whether he will pay off his 'account' in 40 weekly instalments or 10 monthly ones. Burton require that at least 10 percent of the price of a garment is paid as deposit and then add five percent to the remaining balance—this they call a 'service charge' which is levied to help cover the costs of running a credit system.

When a customer wants to buy off-the-peg garments on credit, these are kept for him while the agreement is sent to head office for vetting.

In the case of made-to-measure clothes, the 'measurement form' is despatched to Leeds along with the agreement.

In Leeds the proposed transaction is examined to see whether it is reasonable (*ie*, the would-be customer will have no difficulty in paying the instalments) and then headquarters return a copy of the agreement to the store, and mail the customer *direct* a credit card—on which will be recorded his instalment payments. The credit card is sent to the customer's address to make sure it is his authentic habitat.

Having been advised by the branch manager that his order is ready and with the credit card in his possession, the customer can now go and collect his garment. At this stage he pays his first instalment.

In Leeds the information contained on Burton's copy of the agreement is punched on to cards: the value of each instalment, the stock number, the branch's number, the retail price, the initial deposit paid, the total amount allowed on credit, and the service charge.

These 'agreement information' cards, known as 'new business' cards, are checked, particularly the value of instalments against the total amount or credit and the service charge.

The cards are then held 'in suspense' until, at the branch, the garments are collected, and headquarters are notified of this. Then a pilot card to tie in with each 'new business' card is punched with

- the branch's number
- the order number
- the account number (the number on the customer's credit card)
- the week number of collection.

Once this has been done Burton have on cards all the information required for keeping track of a customer's account.

The pilot cards are merged with their related 'new business' cards for the purpose of pulling those cards relating to garments collected during the week. This is done to be able to find out the 'life' an account will have. Both cards (pilot and 'new business') are put through an ICT 550 electronic calculator which works out how long each account will be opened and how many payments will be due (the credit allowed is divided by the instalment value) and the results of these calculations are punched on to the 'new business' cards.

The cards are separated and then the 'new business' cards are tabulated to give a garments-delivered list which is used for financial accounting purposes at Leeds. The cards are then filed until the updating period.

When a customer brings his payments to the branch store these instalment payments are recorded on his credit card—after each instalment the branch cashier works out the new balance owing on the credit card—and also on the branch's instalment list (see illustration page 13).

Each instalment list has room to record 39 payments, and as credit customers pay their instalments, their names, account numbers, amounts paid in and balances owing are recorded on one line; the date is also recorded against each payment, and when a customer is entitled to an allowance off the service charge for quick payment, this, too, is noted.

Copies of these instalment lists are sent to head office daily. Head office receives these lists from the various branches in random order, but all the accounts and payments on one list have a common branch number.

Cards are prepared from these lists. As only account numbers and amounts paid are punched, six entries can be recorded on one card. Batches of cards are then tabulated and at the same time a control card is produced. On the control card is punched the total of amounts in that particular tabulation run, and this card is used later in the system as a check.

The cards prepared from the instalment lists—payment cards—are filed with the other cards (pilot and 'new business') which give all the details about the various accounts. All the cards are segregated by branches.

## The computer run

Burton update their credit accounts on a cyclical posting basis: each branch's accounts are updated once a month, the computer updating the accounts of a number of branches each day. The computer

Purchased exclusively for one job, Burton's machine, which will handle the accounts of stores like this one, will mean a saving of 100 staff

procedure itself is simple: binary balance cards, each of which holds ten accounts, are first read into the 1202, and the account numbers have been so contrived that they tally with registers on the computer's drum store. Next, the payment cards are read in, and the information they contain is also stored on the drum. When all the cards have been fed in, within the computer old balances are picked up, reduced by the sums that have been paid, and the new balances are recorded on the drum.

At this stage the computer drum holds the new balances and the amounts paid, and all the contents of the drum are printed out. Five account numbers are printed on each line and against these are shown cash paid and balance outstanding.

This print-out is followed by an arrears routine, which prints out separately all those accounts which need attention. Burton have developed a drill for dealing with so-called 'slow payers' which begins with reminder letters and may end in some cases with legal action. None of this, of course, is performed on the computer although the print-out gives all the information such as amount of arrears, date of last payment, amount of weekly or monthly instalment from which the arrears drill can be followed.

Burton state than when a man buys a suit from them on credit, what they want—eventually—for that suit is cash. A suit that has had some wear is no good to them, and they don't want it back. Hence their credit accounting system must ensure that the monies that should be coming into the stores do arrive; also it must be accurate—to notify a man that he is in arrears in his payments when in fact this is not the case could create ill-will. So the company's system carries a number of built-in checks to eliminate errors—particularly errors that might lead to posting payments to the wrong accounts.

One potential source of errors is to be found in the branch stores. The entries on the instalment lists are made by hand, and it is possible for branch cashiers to inadvertently write a wrong account number or else for their entries to be misread at Leeds when the information on these lists is transferred to punched cards. With this in mind Burton have investigated the possibility of preparing the instalment lists in the stores by machine. Bell Punch will shortly supply Burton with a small machine which would print an account number from a plate as well as variable information. The customer's credit card will incorporate a small plate with his account number which he will present each time he goes to make payments, the variable information—how much he paid—being set up each time. With printed, instead of handwritten, instalment lists, Burton will install an Electronic Reading Automaton (ERA, made by Solartron) which would 'read' the lists and punch out the relevant data on to cards—hence eliminating all possibility of 'errors of translation.'

This, of course, is looking ahead, but it is anticipated that the first of these machines will be introduced into the branches in about 12 months' time when ERA has been installed at their head office.

# How to use SERVICE BUREAUX

**For special problems—scientific and statistical—or small volumes of data or as an introduction to electronic data processing, service bureaux are ideal. But even use of a bureau has usually to be preceded by considerable planning.**

W Clarke, *Urwick Diebold Ltd*

THE use of service bureaux has undergone considerable development in recent years, and there is today available for business, technical and scientific purposes, a wide range of computing and data processing services that do not involve owning or the full-time renting of a computer system.

The concept of a bureau is not, of course, new, and long before computers became commercially available there existed punched card service bureaux carrying out a large variety of work. With the advent of large scale data processing units, the possibility of buying time rather than equipment has taken on significance even for the larger company.

The term 'service bureau' will be used not only to describe a centre for renting computer time, but also to include any form of sub-contracting of a computer or related services. Used in this sense, service bureaux range from a fully pledged organisation that takes over an entire problem or application to an organisation that may be willing to make available some of the idle time on its computer, but without offering the related services. In Britain, as in other countries, there are a number of companies who are not using their machines to full capacity, and they may make time available at quite moderate rates to recoup some or all of their costs for these idle hours. Some computer manufacturers who previously concentrated on providing the full service—including luncheons—are now adopting the approach of selling time (without any of the associated frills) on strategically located machines.

Which of these types of services can best serve a particular company or organisation obviously depends on individual circumstances. Companies that are just starting to use such services and have

no internal systems design and programming facilities will be best served by a well organised service bureau that is equipped to do the whole job. The same is true of firms that use computers only for occasional problems and require periodic or one-time solutions to particular problems. Other companies may have their own small computer or mechanised accounting system and merely wish to use outside machine time to handle peak loads or to solve particular problems that require a machine system with greater capability than their own.

## Who Uses A Service Bureau?

1. Companies that do not have sufficient volume of data processing to warrant a computer of their own. Such companies may have an occasional 'one-time problem' to process, such as a marketing or research assignment. Others will periodically have a repetitive operation such as a weekly payroll or monthly or quarterly reports.

2. Companies that are considering the installation of a computer but are sceptical that a 'black box' can actually handle the work. A computer service bureau affords a convenient means to dispel such doubts by permitting the company to see the practical effect of entrusting its work to the computer. Thus for a comparatively small expenditure in service bureau fees, a company can determine by actual experience the relative merits of the computers made by the various manufacturers. However, a word of caution should be sounded here: although a service bureau employs highly skilled and trained staff, a 'one-time' problem does not afford the opportunity for a full knowledge of the work involved to be gained, or for the best solution to be found. These factors must therefore be borne in mind when attempting to consider the results in the light of what might be expected to be achieved by the company with its own installation.

3. Companies that are preparing for their own computer installations. Such companies may want additional time to be allowed by the manufacturers to test and debug their own programs before their automatic data processing system is installed. Furthermore, service bureau experience can provide a good training ground for those employees who will be working in the company's automatic data processing installation.

4. Companies that have computers of their own may resort to a computer service bureau for special work or to take care of peak loads. Companies that have a medium or small computer may have periodically too much work for their own computer facilities but not sufficient volume to warrant a larger installation. Occasionally a company will have a problem that will cost more to run on its own equipment than it will on the giant computers available in some computer service bureaux.

## Preparing the Problem

The preparation required depends, of course, on the nature of the service that is being bought. Where pure computer time is purchased, then an extensive and detailed study by the company is required. Complete systems flow charts must be created and programs prepared. As much attention should be paid to the method of input preparation and output format as to the detailed computer program, and the transport problem—how to get the data to and from a bureau—should also be considered in terms of time and bulk. Nothing can be left to chance as the service bureau is to a great extent working blindly in these cases. Even when the detailed work is given to the service bureau certain preparations are necessary to assure maximum results.

1. THE PROBLEM MUST BE DEFINED. WHAT EXACTLY DO YOU WANT ANSWERED?

Defining the problem is comparatively easy if you have been solving it manually. In this instance, of course, you are thinking of a computer purely in terms of what it might save in money or time. But if you are not already solving the problem, defining it can be quite difficult, particularly when a new concept or new information, not previously available, is involved.

Defining the problem seems an obvious first step. Yet the almost universal complaint of service bureau executives is that customers so often are not able to say exactly what they want.

2. THE PROBLEM MUST BE SUSCEPTIBLE TO SOLUTION BY A COMPUTER. Computers are versatile and they can do a great deal, but they cannot accomplish miracles. To be suitable for solution

Companies just starting to use computer services and with no internal systems design and programming facilities are best served by a service bureau equipped to do the whole job

by a computer, a problem must meet certain requirements.

A very brief outline of the problem will be sufficient to enable a service bureau manager to answer this question.

3. THE PROBLEM MUST BE ECONOMICALLY WORTH SOLVING BY COMPUTER.

If you are already solving the problem manually, you merely compare your present time and cost for doing the problem with the maximum time and cost estimated by the service bureau after they have looked into the problem. Normally, to justify the processing fee, the present cost must be well above the maximum cost estimated by the service bureau.

If you are not doing the problem at present, this necessitates your putting a monetary value on the estimated worth of having the new information, or having the problem solved. Naturally this estimate must be less than the maximum cost estimate submitted by the bureau.

4. IN WHAT FORM IS THE INPUT AVAILABLE AND IN WHAT FORM DO YOU WANT THE OUTPUT?

From the bureau's point of view, such information is extremely important in determining an estimate of time and costs. If the input data that is to be submitted to the bureau in order to solve the problem is in the form of punched cards, paper tape or magnetic tape, processing will be far easier (and hence cheaper) than if the raw data is in the form of source documents.

5. OTHER ESSENTIAL INFORMATION IN THE EVALUATION OF THE PROBLEM:

▶ Is the available input information of sufficient quantity and scope to produce the desired output?

▶ Is the input information in a form that is easily read and prepared for transcription to machine language?

▶ In what form do you want the output? The work involved in preparing output in the form of punched cards, paper tape or magnetic tape is far simpler than if it is to be in the form of a finished document. This information is necessary if the computer is to be given the precise instructions necessary to process the problem through to the desired solution.

▶ If the output is to be in the form of a finished document, what is the precise layout to be? Of what size and form is the required stationery? (The form of the input-output is important because it determines what peripheral equipment is necessary in the solution of the problem.)

## Preparing the Estimate

After the potential customer submits the description of his problem, he first wants an estimate of the cost and the time required to produce the information he is seeking. Before even preparing the estimate the service bureau will require to be satisfied on certain points.

1. The problem must be completely stated.

Last year AUTOMATIC DATA PROCESSING published a series of articles on the work that was being done on the computer centres set up in london by the various computer manufacturers. (See AUTOMATIC DATA PROCESSING VOLUME 1, NUMBERS 2, 3, 4, 5 and 6.)

At that time a great deal of work done—over 50 percent—came under the general label of 'scientific and technical': engineering calculations, concerned with as divers subjects as dam-building and wind tunnel tests. The picture remains much the same today, for the nature of this work lends itself to the quick visit to a computer bureau where it is known that a library of subroutines can be quickly tapped—for the rapid solution of, yes, the one-off problem.

Below are given the charges levied by the various London computer bureaux:

| Centre | Computer | Price per Hour |
|---|---|---|
| English Electric | Deuce II | £30 |
| Ferranti | Pegasus | £50 |
| | Sirius | £15 |
| IBM United Kingdom | 650 | £27 10s. |
| | when linked to 407 line printer | £36 |
| Leo Computers | Leo II 1 | £35-£50 |
| | Leo II 5 | £55-£70 |
| National Cash | 405 | £40 |

2—The problem must be mathematically sound.
3—The solution must be practical.
4—The input data must be adequate in volume and scope. It must also be available in a usable form.

How long the service bureau requires to make its estimate depends upon the complexity of the problem, the quantity and quality of the information available, and how much pioneering work is required as far as the programming is concerned. A problem requiring more or less standard programming techniques may take only a few hours to estimate. A problem, on the other hand, that requires a unique program may take several weeks.

In preparing the estimate a service bureau goes through five basic steps.

First, the method of attack. The programmer must decide his broad approach to the problem.

Secondly, a detailed flow chart is made to determine the number of steps and sub-routines. These must coincide with the specific instructions the computer will execute. Where possible the problem is made to fit available sub-routines. The flow chart is used to show graphically the logic of the approach and to determine the storage requirements. The greater the usefulness of the bureau's library programs and the less sophisticated the debugging techniques, the shorter the time required to solve the problem. The ability and experience of the programmer will always enter into this estimate.

Thirdly, an estimate is made of the total number of hours it will take the programmer to plan, program and debug the problem.

Fourthly, an estimate is made of the actual computer time necessary to solve the problem.

And fifthly, the service bureau's personnel and computer commitments must also be taken into consideration. This is necessary in order to give the customer the approximate date when the problem can be started. Estimates usually include this. A bureau that is already carrying an extremely heavy load may hesitate to take on a problem that requires a rigid deadline, such as a payroll.

Clearly a company that buys nothing more than time on a computer must obviously undertake these steps itself and then make arrangements to have sufficient computer time available.

In making such plans, it is important to provide for intermittent time to test and debug the program, in addition to the actual machine time required to run the problem.

Service bureaux can be used in many ways. They are valuable to firms that have occasional problems in the business, technical or scientific fields and to companies with occasional problems requiring greater capacity equipment than would be justified by their normal needs. Also for the smaller firm which, in anticipation of growth or for the sake of immediate management improvement, may want to convert certain applications without the full cost of obtaining a computer, they can fill a need. In practical terms, there is no reason why computer jobs done on a service basis should not be performed as smoothly as in purchased equipment. Unsatisfactory results may often be traced merely to the fact that the areas of responsibility were not clearly defined, particularly when it is not clearly established what part of the operation is the company's own responsibility and what exactly is required of the service bureau.

With rare exception, employment of a service bureau has necessitated a piecemeal, application by application approach, and therefore has not provided a company with the real advantages of an integrated system. Where such integration or full use of computers is not possible, or cannot be economically justified, purchase of computer time and service can still provide real benefits. It is not, however, a substitute for an effective automatic processing system.

## THE FUTURE FOR SERVICE BUREAUX

**In Britain computer service centres were first begun by the manufacturers. In order to sell computers, each manufacturer needed to put a computer in a 'shop window' to lure prospects. Soon it became obvious that the 'shop window' computer could well be put to work and so it was—at first, in some cases on intra-company problems, and then later on a commercial basis for outside organisations. Now manufacturers are moving machines into their provincial offices to cater for organisations outside London.**

**But it is to be expected that future bureaux will not be run exclusively by the manufacturers. Already some of the universities with computer installations offer time on their machines to local businessmen. This trend will continue, particularly when the universities begin to purchase large machines and need to find a source of income to pay off their purchases.**

**Also one or two organisations may be set up purely to go into the computer time-hire business. This has already happened in the USA and one American company, the Corporation for Economic and Industrial Research, is currently setting up a British subsidiary.**

**Quite apart from individual companies who might start up time-hire services as a side-line to take up slack time on a machine, local government bodies and trade and research associations might enter the time-hire business.**

**Thus for the would-be user, particularly the small firm, the outlook is bright.**

# The Harrogate

**Over 350 people travelled to Harrogate last month to attend the second annual conference of the British Computer Society. Did they all go home the wiser?**

MY ideal conference would be one where speakers always spoke into the microphone and were struck by a specially weighted chairman's gavel when they mumbled inaudibly to the blackboard, where symposia panelists had collectively connived to cover a subject beforehand so that their contributions were as clear and logical as successive chapters of a well-written book, where conferees were not subject to excessive draughts, and where circulated abstracts of papers were not merely occasionally indicative of what speakers would say.

Alas, the second conference of the British Computer Society was not my ideal conference. I suspected this would be so when I learned it was to be held in Harrogate—not my favourite spa. Still, there we were again—the boffins, the salesmen, the users and programmers—nearly 400 of us, they told me in the Press office, with *delegates from overseas, too*, gathered to hear about the state of the 'art.'

Certainly, this was a slicker conference than last year's. The society, having learnt something about public relations, no longer hides its light under a bushel. (There was a rumour that the society's council invited Lady Lewisham to open the conference but she regretted . . .) An emblem with the letters 'BCS' picked out has been designed and this adorned folders, abstracts and lapel badges, while blown-up versions of it were in the conference room of the Sun Pavilion (a real misnomer, this). From the proscenium arch—for the chairman and speakers were elevated to a stage this year—the organisers hung a white board on which was printed a quotation from Nansen:

> *'The history of the human race is a struggle from darkness to light. Man wants to know and when he ceases to do so, he is no longer man.'*

With this exhortatory, if tautological, thought before them, conferees settled down to become men.

BCS conference procedure resembles in one respect that of the US Congress; Congress members are limited to five-minute speeches on some occasions but are allowed to publish lengthier

# Conference

unspoken speeches in the Congressional Record. Similarly, some conference speakers gave brief resumés of the papers they had prepared, while the papers will eventually be published in full in the society's journals.

In this way a great deal of ground was covered—on the progress toward a common language and in autocodes, on the use of computers for a variety of commercial purposes from market research analyses to invoicing in a shoe company, on university and commercial computing centres, and on simulation studies in process control and planning.

## Wired-machine problems

In the symposium on computing centres, Mr A H Beaven, of National Cash, reported that the idea of producing computer input tapes on automatic punches coupled to accounting or adding machines was gathering momentum, and outlined three computer service jobs prepared in this way. Obviously the wired-machine idea (accounting machine coupled to tape or card punch) has certain attractions for the small and medium-sized firm, particularly when it is realised that computer time-hire is not necessarily expensive, but the use of by-product tapes poses certain problems with regard to error routines. Mr. Beaven, commenting on his company's experience, explained that operators of the tape-originating machines needed a simple set of instructions for correcting data or operating errors, while the computer program needed to be able to deal with a number of error symbols.

Mr A R Bagshaw, of Ferranti, raised the novel point that when his company's London computer centre took delivery of a time-sharing Orion computer, the problem would arise of how to charge customers when two jobs were being run at the same time. Mr Bagshaw did not pretend he had all the answers. However enough was said to make the point that for companies in the computer service business time-sharing machines would have some weighty advantages—particularly whenever a customer began encountering some of his errors.

Automatic coding, as I mentioned above, was again on the agenda. The Society's president, Dr Maurice Wilkes, in his opening address, spread the word that ' the real breakthrough on automatic programming on the business side has yet to come.' It was left to Mr R M Paine, of ICT, to reason why. The idea of developing a machine language which was also English had been over-

*Continued on page 33*

# Controlling Maintenance Stores in the Reed Paper Group

**A lot of capital is tied up in a papermaking machine and down-time must be kept to a minimum and machine replacements always on hand. This is why one of the first jobs Reed put on their computer was 'maintenance stores control'**

THE mills and factories of the Reed Paper Group, which consists of 20 associated companies, are scattered throughout England, Scotland and Northern Ireland. The head office is in London, at 105, Piccadilly, and several mills including the largest, at Aylesford, are in the traditional papermaking country of the Medway valley in Kent.

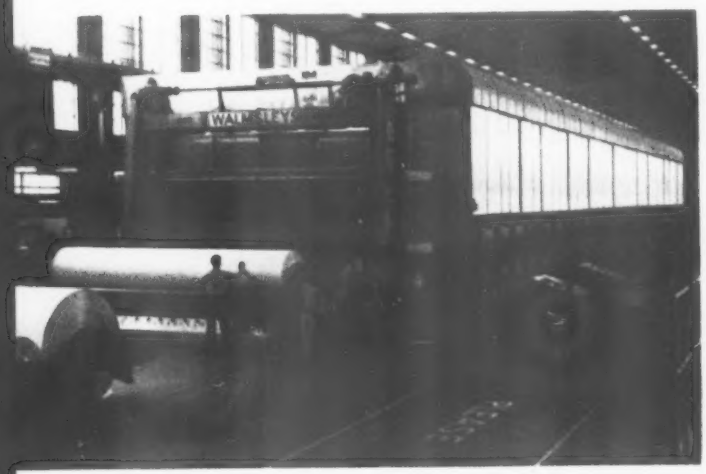
Group policy has been to combine resources and services in a central pool and at the same time to allow to the associated companies their own identities and traditions. The group's physical resources, particularly in respect of research and development, are at Aylesford, where there are 6,600 employees in mills, factories and workshops occupying 500 acres.

In addition to making newsprint and other printing papers, the Reed group manufactures wrapping papers, tissues, paper sacks, corrugated fibreboard and laminated plastics. The list is not exhaustive: diverse activities have grown out of the business of papermaking. For example, the group designs and manufactures sack-filling machinery for its customers; and investigation of the printing qualities of papers is conducted in the research and development laboratories at Aylesford, where, also, the group's vehicles are maintained and serviced by Reed Transport Ltd.

Although, in line with the general policy, each of the 20 companies is a self-accounting unit, all of them can call on a central data processing department for service. For a number of years this was provided by electro-mechanical punched card equipment. In 1954, Reed decided to order a small punched card computer, not only to improve the service but also to gain experience of what was then the new field of electronic accounting. However, after considering their needs still further, they eventually came to the conclusion that it would be better to have a somewhat larger machine with extensive magnetic data-storage facilities.

As a result of this decision, they ordered a National-Elliott 405 computer in March 1957. The equipment, including magnetic film units and an off-line machine for converting the output films into punched paper tape, was delivered about 18 months ago.

During the intervening period, Reed recruited programming staff and enlarged their O & M section in order to deal with the comprehensive systems analysis which was necessary before programs could be written. They also erected a specially-designed building to house the computer system.



Reed's newest papermaking machine. No. 13, is the most highly instrumented in Britain. Down-time on machines of this size is inevitably expensive and must be avoided

Program development was done on one of the manufacturers' machines, with the result that Reed were able to start productive work on their own 405 only a few days after it passed its acceptance tests at the end of 1958.

## Choice of first job

The first application was stores control and accounting for maintenance materials. Reed selected this because:

1. It made full use of the machine's facilities.
2. A considerable volume of data in random order had to be processed to reasonably strict timetables for a number of group companies, and this also necessitated a fairly large amount of printing.
3. It seemed that there were opportunities to make definite savings over and above any speeding-up of the clerical work or elimination of manual effort.

The economic operation of large papermaking machines, together with the ancillary boiler-house and generating equipment, depends very largely on the minimising of downtime caused by unforeseen breakdowns. It is also essential that preventive maintenance should be achieved with a minimum loss of productive time. Similar considerations apply in the converting factories making multi-wall sacks and corrugated containers where, although plant units are not so large, the breakdown of one unit may very well have repercussions upon others in that the flow of partly-processed work from one machine to others is impeded.

It is therefore most important to apply a satisfactory system of stores accounting and control to the multitudinous material, machine parts and spares which must necessarily be stocked to ensure that machines are kept in productive use. The maintenance function is subdivided in the larger mills so that mechanical, electrical, boiler house, instruments and civil engineering are each the responsibility of a maintenance department head, the departmental needs being supplied by a separate store controlled by the departmental chief engineer, who is primarily responsible for ensuring that he does not run short of vital materials.

It is also necessary to ensure that finance is not tied up in unduly large stocks. The importance of this can be assessed from the fact that in one division alone the cost of maintenance exceeds £2,000,000 per annum, of which almost 60 percent is material cost.

The new computer system provides the necessary control. Currently, it is being operated in seven of the group companies and covers over 70,000 stock items with a total value of some £1,500,000.

The system is essentially a file-updating application in that the stores ledgers, now maintained on magnetic film, are regularly updated in respect of all stock movements that have occurred since the previous run. At the same time, information about exceptional items is printed for action, and analyses of the value of materials used on various machines are provided. The up-dating is done weekly instead of monthly, as under the old system.

The weekly reports requiring action include lists of stock items where the quantity held in stock is above maximum level, lists of stock items where the quantity is at or below the re-order level, lists of items where the quantity is at or below minimum level, and lists of items purchased at prices that varied by more than 10 percent from the current average price.

These and other reports, appropriately acted upon, ensure that strict control is achieved. In respect of each weekly updating run there is also produced for accounting control purposes a full

statement of the transactions that have been processed, showing opening balance values, receipt and issues values, and closing balance values for each store stockholding. Occasional reports, produced when required, provide information in respect of redundant and slow-moving stocks and valuations of stocks at maximum and minimum levels in comparison with the actual value of stocks held.

## Take-over tactics

The stores application was taken over gradually, starting with one small section. Previously, the programs (involving some 8,000 instructions) had been exhaustively tested by running dummy data which included all conceivable 'abnormalities'. Nonetheless, it was still necessary to make sure that they would work just as well with normal operating data, and for this reason the computer system was run in parallel with the old punched card system for six weeks. During the parallel running, Reed compared the results obtained from the two systems and reconciled them as far as was necessary to provide evidence that the computer system worked.

After the first section, representing about 6,000 stock items, had been taken up successfully, the period of parallel running was halved for the second section of roughly the same size. Thereafter, new sections were brought into the system without any parallel running at all, at intervals of three or four weeks.

Each take-over involved negotiations with the management of the company concerned, for although the data processing department was using a common computer program to process the data, it was still necessary to attend to local needs in the organisation of procedures. There was also the not inconsiderable work of setting up stores ledger records on magnetic film.

## Bin records

It has been decided to retain ordinary bin records for the time being. These records, kept in the form of loose-leaf ledgers, are concerned only with quantities, but contain information on maximum, minimum and re-order stock levels in addition to suppliers' names, delivery periods and quantities held.

In this way, the ordering of fresh supplies can be put in hand at the earliest possible moment — that is, when the storekeeper makes and records an issue and sees that the resulting balance is at or below re-order level. When the computer processes such movements, perhaps several days later, it produces an 'exception' report on all items at or below re-order level, and on the strength of this 'chasing' action can be taken to ensure that the new orders have been placed.

The retention of bin records by the individual companies using the central computing service is primarily a safeguard against sudden surges in demand. It also reflects the fact that the maintenance stores system is concerned with items for which the rate of usage cannot be readily or accurately predicted.

Reed are hoping to improve the definition of their maximum, minimum and re-order levels by computing these in the light of usage over a fairly long period, and also taking into account the maintenance engineers' assessments of the number of weeks' stocks it is desirable to hold. *They hope to achieve a reduction of about 15 percent in the finance locked up in stock — representing a saving of about £20,000 a year.*

All stores receipts and issues are recorded on the appropriate documents, and after these have been used to update the bin records they are sent to the computer department. There the prime information is punched into paper tape in random order. After the tapes have been verified, the information is sorted by the computer into strict chronological order. The computer then updates the ledger films in respect of all stock transactions, provided the information passes a number of checks written into the programs. Among these is a 'line number' check described below.

The storekeeper's ledger is made up of ledger sheets, each containing 81 lines, consecutively numbered. The sheets are given suffixes, so that the numbered lines contained in three consecutive sheets (all for the same commodity) in effect form a cycle of 243 lines, numbered from 1/1 to 81/1, followed by 1/2 to 81/2, and 1/3 to 81/3, when the cycle will begin again at 1/1. The suffix becomes an integral part of the line number and is recorded at the top righthand corner of the ledger sheet.

The ledger sheets record the commodity code number and the maximum, minimum and re-order stock levels. The ruling of the sheets facilitates the separate recording of quantities received, quantities issued, quantity balance in stock and the deployment of stock at sub-stores.

The stores ledger maintained on magnetic film contains the following information for every item of stock: (1) commodity code number; (2) maximum stock level; (3) minimum stock level; (4) stock re-order level; (5) unit of quantity code; (6) quantity in stock — unvalued; (7) quantity in stock valued; (8) value of stock; (9) average price; (10) storekeeper's ledger line number of the last transaction 'actioned' by the computer; (11) number of the week in which the last transaction was processed by the computer; (12) net quantity of issues to date; (13) net value of issues to date; (14) quantity balance error, if any.

Before amending the stored information, the

*Continued on page 38*

# The Colson Notation

L R C Haward

THE obvious superiority of the digital system in electronic processing of data, has led to a tendency to ignore alternative systems which might have some value in certain cases of data manipulation. While any binary principle of the 'go not go' pattern must, of electronic necessity, be the simplest one on which to base a computing system, this does not mean that it is the only desirable principle, or even that it is the most efficient one in any one given situation. New devices which are designed to reduce continuously variable information into discontinuous quantal form, such as Shaw's Analogue-Digital Converter, are capable of transforming information into any form of unitary system by utilising common principles of conversion, and such equipment widens considerably the horizons of automatic computing.

The binary system, simple though it is to the machine, is not easy to manipulate mentally by individuals educated on the decimal system. There is, in consequence, a wastage at both ends of the operation when data have to be converted from the decimal to the binary system and back again for evaluation and interpretation. This is not, perhaps, of particular importance in itself. The speed of programming a sequence of computer operations is such that conversion factors occupy an exceptionally small part of the total time required. In certain circumstances, however, it may be necessary to inspect and work direct from information on punched tape, when the time lag due to mental conversion immediately becomes noticeable. It is in such a situation that a relatively unknown system is often applicable.

This is a notation which finds one of its most useful applications in the two types of summation most commonly met with in statistical handling of numerical data. It provides a simple and rapid method of mental computation, making an effective compromise between decimal and binary systems although actually based on the former. It also lends itself to automatic processing using six units and one operator. This system is known as the *Colson Notation* [it is based on a mathematical foundation which is beyond the scope of the present article; it also possesses important theoretical implications which are not immediately relevant to this simple introduction, and which are discussed elsewhere*].

One of the many features of the notation which possesses psychological importance is the elimination of the decimal digits above a value of five. These are replaced by a negative form of the first five digits, which ordinarily possess a positive value as in conventional usage, and which are used here in combination with digits of a higher power of ten. The symbolisation of these negative values is effected by inversion of the traditional Arabic numeral, thus:

Value:

$-5$ $-4$ $-3$ $-2$ $-2$ 0 1 2 3 4 5

Symbol:

ς ϧ ε ζ 1 0 1 2 3 4 5

Known as the *Colson Scale*, it is particularly useful in those cases where data possess naturally both positive and negative values, such as a histogram or Cartesian graph with negative ordinates, or in a discontinuous version of a cyclic variation, based on, for example, a sine wave. For the purposes of verbal, as opposed to numerical, communication, the negative values are given a name:

quin quad trip doub neg null

5 4 3 2 1 0

and the cardinal numbers therefore ascend as follows:

1, 2, 3, 4, 5, (or 1ς) 1ϧ 1ε 1ζ 11 10

It will be seen that here is an alternative form of the fifth value, and use is made of the alternative forms when setting out a column of figures to be added. The reason for the alternative forms will become clear when the process of mental summation is described.

The Colson Notation is in some ways analogous to the Roman rules of numeration, in which negative numbers are used. In the latter, however, negation is indicated by precedence, thus giving to Roman numbers their characteristic length. The Colson Notation is very much more flexible

and, by retaining decimal placement, restricts the space occupied by the number and so avoids the unwieldy length of Roman numeration. The selection of the inversion symbol is perceptibly efficient and psychologically sound, for it makes use of existing memory traces by which the fundamental value of the symbol can be recognised, at the same time producing a discreet difference in orientation which denotes its algebraic value. The use of a conventional symbol also has particular value typographically, for it enables a standard teleprinter or similar automatic printing devices to be used with minimal modification. For mental operations, its chief importance lies in the fact that a vertical arrangement of numbers can be made in such a way that each column has a common multiplier, that is, in the present scale each number in any column is raised to the same power of ten. This is, of course, a *sine qua non* for efficient mental summation, and readers who have made a study of Roman numeration theory may be interested in comparing the two notations:

| Number | System | Roman | System | Colson | System |
|---|---|---|---|---|---|
| 1, 2, 3, 4 | $10 + n$ | I, II, III, IV | $p_1 \times n$ | 1, 2, 3, 4 | $10 + n$ |
| 5 | $10 + n$ | V | $p_2$ | 5 or 15 | $10 + n$ / $10^1 - n$ |
| 6, 7, 8 | $10 + n$ | VI, VII, VIII | $p_2 + n \times p_1$ | 14, 13, 12 | $10^1 - n$ |
| 9, 10, 11 | $10 + n(9)$ / $10^1 + n(>9)$ | IX, X, XI | $p_3 \cdot n$ | 11, 10, 11 | $10^1 \cdot n$ |
| 1960 | $10^3 + (10^2 \times n) + (10^1 \times n) + (10 \times n)$ | MCMLX | $(2p_6 - p5) + (p_4 + p_1)$ | 20 + 40 | $(10^3 \times n) - 10^1 \times n)$ |

Conversion from Roman to Arabic numeration is difficult because in the former case the individual value of any symbol cannot be assessed until reference is made to its position in the number as a whole. In the Colson notation the intrinsic value of each symbol is constant: although, because of our teaching, 1960 conveys its meaning quicker than does 20ϕ0, which is at first converted mentally to 2000 − 40, such a delay is more than compensated by the speed of computation with Colson notation. With practice this delay gradually disappears, for familiarity enables number groups to convey their meaning direct without the necessity of further conversion. This mental adaptation is a familiar one to those who have learnt a foreign language, for an easily recognised stage is eventually reached when a foreign word conveys its meaning directly without requiring translation into the mother tongue first. In mental arithmetical processes, however, the time required before the intermediary stage is eliminated is remarkably short, and the apparent clumsiness common to any new technique soon gives place to a mental dexterity in which the advantageous characteristics of Colson Notation are obvious.

As will be realised by the mathematician, Colson Notation is very useful in algebra. Some of its simple arithmetical rules enable short cuts to be made in the evaluation and interpretation of taped information—particularly when checking for programming errors—and the three most important ones are:

(1) A perfect square cannot end in 2, ϛ, 3, or ε.
(2) The cube of a whole number ending in N ends in N or ϟ.
(3) All prime numbers except 2 and 5 end in 1, ɻ, 3, or ε.

Having provided a brief outline of the notation itself, we can now examine its application to statistical computation. Its unique value here lies in the facility which it imparts to simple summation—always the most tedious process whether executed by brain or machine. It has been claimed that using the Colson Notation numerical data can be summed quicker in the head than with the aid of an electric calculating machine, but the speed of computation is actually a function, mathematically speaking, of the range of symbols existing in the data. The greater the range of values, the simpler becomes summation: as the range becomes narrower, the time required to add a column of figures increases, until in the end case of a column of identical numbers, the time required would be no less than that for a conventional process. For automatic computing, values which involve the numbers 6 to 9 are registered with a negative process as well as a positive one. Nine, for example, would mean a negative change in its own column and a positive change in the column of the next higher power. For mental calculations, the rule is to cancel out the positive and negative pairs and add the remaining digits; this is, of course, what the machine is doing cumulatively. Some concrete examples may make this process clearer:

| | | | | |
|---|---|---|---|---|
| 7 | 1 ε | or | 11ɬ | 106 |
| 1 3 | 1 3 | | 53 | 53 |
| | | | 1ϛ4 | 84 |
| 2 0 | 2 0 | | 1ε2 | 52 |
| | | | 12ε | 117 |
| | | | 11ϛ | 88 |
| | | | 500 | 500 |

At first glance, it may be thought quicker to add the columns in a conventional way, but trials which have been carried out with University and WEA groups showed that after a few minutes' explanation of the process of conversion and cancellation, summations could be carried out in approximately half the time required for the conventional methods. As an illustration, the mean time required to evaluate:

$$\sum_{n=1}^{n=30} (n)$$

was 47.6 seconds using Colson Notation and 78.4 seconds using the traditional method of addition. By reducing computation time by nearly fifty per-cent, the Colson Notation has a justifiable place in modern business methods. In automatic computing, it requires only four channels for unique identification of each unit and still leaves two patterns as spares, so that on standard five-channel tape an additional mathematical operator as well as the necessary plus-minus operator can be incorporated. When using Colson Notation on punched tape, visual inspection and evaluation is extremely simple and perceptibly very much more efficient than the punched patterns of the binary code, although the latter is mechanically more efficient when human intervention is negligible. There is, however, tremendous scope for the Colson Notation in any process where mental summation is a necessary stage in the ordering and manipulation of data. In such cases it offers a practical way to reduce labour and improve efficiency: a preliminary trial will prove its immediate value, while for those who adopt it as part of their methodology experience will bring a facility in computation which is comparable to possessing an extra-personal aide.

* *Smith, C. A. B, 'Biomathematics.' Griffin, London, 1954.*

# Accounting for 800 Million Telephone Calls

EACH year the GPO's telephone operators prepare some 800 million tickets for trunk and toll calls made in Britain. The information provided on these tickets is essential to the Post Office's accounting procedures and to preparing 10 million telephone accounts for subscribers. It was realised some time ago that the business of preparing these bills might well be done on punched card equipment, and, in fact, investigations to gauge the feasibility of doing just this were begun ten years ago.

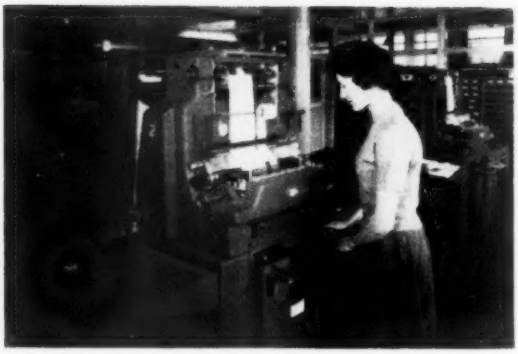
Recently, a pilot Mechanical Ticket Processing (MTP) unit began work in the Telephone Manager's Office in Manchester. It processes information from 55 million tickets for calls made by some 350,000 subscribers connected to over 170 exchanges in the Manchester and Liverpool telephone areas; (it is planned that later it will take over the same kind of work for the Blackburn, Lancaster, Preston and Chester telephone areas, and will thus be doing work for the whole North West).

The result of collaboration between engineers from the Post Office and from ICT, the new MTP system in fact uses electronic as well as electro-mechanical techniques. It provides a solution to the problem of automatically converting manually recorded information on call tickets in a form suitable for machine processing—in this case punching holes in tickets.

The recording medium used is now a telephone ticket printed on a small 40-column card. Telephonists write and mark information on these tickets, which are subsequently fed to photo-electric mark scanning punches. These scan the marks on the tickets and punch out a hole for each mark, thus converting each ticket into a punched card. The 'marked' information is limited to the calling subscriber's number and the call charge—usually the only information that is likely to vary. (The mark scanning punch has also facilities for non-variable information, such as a date, to be preset and punched into tickets.) These punches work at the rate of 90 cards a minute.

Naturally, these toll and trunk call tickets are

*About 7,000 tickets are sorted an hour; each ticket has to be sorted four times*



*The end product—the telephone bill. 30,000 come from this machine each day*

prepared in random order. Initially, they are filed in this state; then, when required for account-preparation purposes, they are put into a high-speed sorting machine and sorted under individual subscribers' telephone numbers.

For calls other than toll or trunk, *ie*. local calls, the Post Office prepares a punched card for each 'local call unit' and ICT have developed a special high-speed summariser to GPO specifications which summarises in one card the many local call unit cards that may have been prepared for each subscriber. The machine works at the rate of 200 summaries a minute and cuts out the need to retain thousands of detail cards.

With punched cards prepared for each toll and trunk call made by a subscriber, and with a summary card of his local calls, the Post Office have all the 'raw data' required to prepare his bill. The cards are then put through a special tabulator which prints:

—the date and charge for each toll or trunk call.
—the charge for local calls.
—the total owing.

As with most tab operations, this is done automatically on a continuous band of paper.

The Post Office plan to set up other MTP installations in Leeds, Cardiff, Portsmouth and London within the next 18 months, and the work of other centres will be similarly mechanised later so that within a few years all telephone call ticket processing in Britain will be mechanised.

The GPO claim that by introducing MTP such monotonous manual work is eliminated, and human errors—mistakes in translating handwritten information to punched cards—obviated. Also, in the Manchester area, despite increased telephone traffic and therefore more tickets to prepare, less staff are employed than before MTP was introduced.

# COURSES AND CONFERENCES

*29 August-2 September*
Programming course on the 802 and 803 computer (principally for members of Universities and Technical Colleges)
*Organised by* National-Elliott
*Venue:* Elliott Brothers Ltd, Computing Division, Elstree Way, Borehamwood, Herts

*5-9 September*
Second International Conference on Operational Research in Aix-en-Provence
*Organised by* International Federation of Operational Research Societies
*Venue:* Aix-en-Provence
*Enquiries to:* Miss G M Heselton, B.Sc, Secretary, Operational Research Society, 64 Cannon Street, London, EC4

*5-9 September*
Programming Course for Deuce
*Organised by* Glasgow University, Computing Laboratory
*Venue:* Glasgow University
*Enquiries to:* The Secretary, Computing Laboratory, The University, Glasgow, W2

*5 September for 2 weeks*
Programming Course for LGP-30 electronic computer
*Organised by* Royal McBee Ltd
*Venue:* London
*Enquiries to:* The Computer Department, Royal McBee, 36 Worship Street, London, EC2

*5-23 September*
Course on the Emidec 1100 computer
*Organised by* EMI Electronics Ltd
*Fee:* 50 guineas
*Venue:* Hayes, Middx

*12 September for three weeks*
Course on Business Application of Electronic Computers
*Organised by* Computer Consultants Ltd
*Fee:* Five guineas per day
*Venue:* Cora Hotel, Upper Woburn Place, London, WC1
*Enquiries to:* Computer Consultants Ltd, Cecil Court, London Road, Enfield, Middx

*12-28 September*
Programming (STAC) System for Deuce
*Organised by* Glasgow University
*Venue:* Computing Laboratory, Glasgow University
*Enquiries to:* The Secretary, Computing Laboratory, The University, Glasgow, W2

*14-23 September*
Programming Course for Ferranti Pegasus
*Organised by* The University of Southampton
*Venue:* Southampton University
*Fee:* £5.5.0 (residence £11.11.0)
*Enquiries to:* The Director, Computation Laboratory, The University, Southampton

*3-7 October*
Course on Autocode
*Organised by* The Staff of the Computing Machine Laboratory
*Fee:* £10 10s.
*Venue:* Electrical Engineering Department, Dover Street, Manchester, 13
*Enquiries to:* Miss C M Popplewell, Electrical Engineering Laboratory, The University, Manchester, 13

**AMERICAN REPORT** from John Diebold and Associates

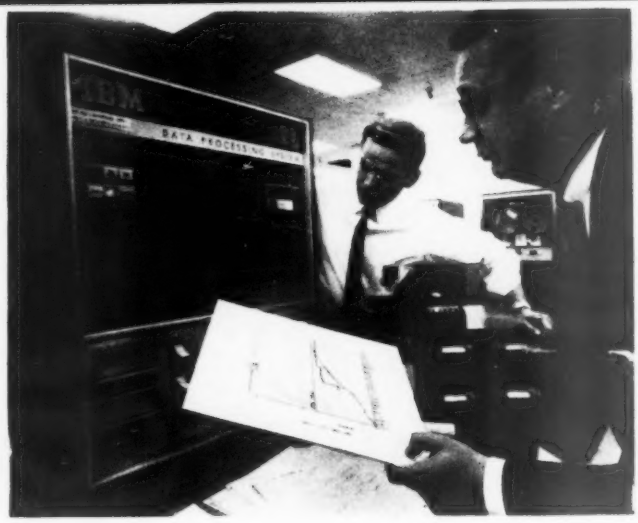
# *Communicating Data by Microwave*

**Following on last month's article on solutions to the communications problem comes a report on the use American organisations make of private microwave systems to link computing centres**

WITHIN the past two months, the Rocketdyne Division of North American Aviation Inc inaugurated the latest stage of its powerful network of commercial computers. This links its laboratories and test stands in California, Texas, and Missouri by leased wire to two large-scale IBM 709's at company headquarters in Canoga Park, California. The Rocketdyne system, in turn, is connected by microwave—ultra high-frequency radio—to four more big computers at North American's Los Angeles division thirty miles away. This latter IBM Teleprocessing data system, developed in co-operation with the Pacific Telephone and Telegraph Company, allows six computers in the Canoga Park-Los Angeles area to 'talk' to each other at the rate of 75,000 words per minute.

North American's point-to-point system was established under a development licence. But it indicates that increased use of this form of high-speed, high-capacity data transmission will inevitably occur in large-scale information handling as soon as the Federal Communications Commission grants permanent licences. At present, the businesses in the United States to which microwave transmission licences are granted are railroads, utility companies; federal, state, and local government; police, fire, forestry service; independent telephone companies, the Bell Telephone System; and the petroleum and gas industry.

Rocketdyne use a microwave 'dish' to relay transmissions *over* mountains



Graphs for management—the computer produces 200 in 12 minutes ▶

Admittedly, use of the broad bandwidths made available by microwave will be advantageous only to those handling the extremely large volumes of data needed to justify this transmission economically. However, one manufacturer of radio transmission equipment has informed John Diebold market researchers that, of the substantial backlog of potential users of microwave for whom it has developed systems proposals pending FCC sanction for private use, all, without exception, said that transmission for data processing loomed large in their consideration.

Westinghouse Electric Co are one of the large manufacturing organizations which have gone on record as a potential user of microwave transmission. Their communications service is now obtained from common carriers. It is claimed that Westinghouse teletype requirements increased more than tenfold between 1940 and the present, and that the need for communication with their 2,500 dealers is expanding rapidly.

Microwave transmission must be beamed in unobstructed straight lines. For the immediate future, range will probably be limited to a 30-mile radius, for other than right-of-way users such as utilities, pipe lines, etc. Thus for most users, the long jumps will be handled by tie-ins with the communication common carriers (as is the case with North American Aviation). This limitation is not because of proposed FCC licensing restrictions. Beyond approximately 30 miles, booster or 'repeater' stations are required for successive 30-mile hops, and for most manufacturing and commercial companies many hops would probably prove uneconomical.

In 1959, FCC released its 'Report and Order,' dated July 29, 1959, terminating the proceedings. This report stated the Commission's position, and advised that specific rule changes would be forthcoming. On the main issue with which we are here concerned, this order in essence stated that authorisations would be granted for intra-city or local area operations on frequencies of 10,000 to 16,000 megacycles, for point-to-point operations in 'Business Radio Services.'

However, before implementing this statement of policy, the FCC issued a stay of action order, on petition of the communication common carriers. The carriers protested that the issuance of such private licences would be detrimental to their operations, and would not be in the best interests of a properly developed communications system for the country as a whole.

There the matter rests at the moment. However, there appears to be widespread conviction that the July 29, 1959 Report and Order will shortly be implemented by appropriate rule changes. Manufacturers of microwave and auxiliary equipment are apparently governing developmental programs accordingly.

## The 'Big Picture' for the User

What, broadly, is the situation as far as the user is concerned? Three important factors are involved: (1) ultra-high frequency bands (to minimise frequency conflict with other types of transmission in highly populated areas); (2) economic considerations vis-à-vis other commercially available transmission media; (3) reliability.

*1—Frequency Bands*

Commercial microwave equipment available now will not be suitable, and modifications must be made. However, we are advised that this presents no particular problem, and suitable equipment will be generally available within a year.

As a matter of fact, one of the large suppliers, Motorol Communications and Electronics, Inc, is prepared to provide microwave equipment in the 10,000 and 16,000 megacycle band upon release of frequencies by the FCC. This wide-band equipment will be capable of handling any type of channelling likely to be required. Other important suppliers of microwave equipment will be Collins Radio Company, ITT Laboratories, General

The files of two rockets ▶

Electric, Westinghouse, and RCA. The last-named will have the advantage of supplying a developed computer system also.

Wide-band data (digital) handling channels will require bandwidths of the following general categories:

(a) For a system with a 15K character-per-second transmission rate, the channel will require a bandwidth of 250KC.

(b) For a system with 62.5K character-per-second transmission rate, the channel will require a bandwidth of 1040KC.

A standard grade channel, or even a standard high grade, high-fidelity channel supplied by a telephone line would not be adequate to carry this information, and broadband microwave channels will be required.

2 *Economics of Applications*

The wide bandwidths to be made available can be likened to a broad highway, allowing a much heavier volume of traffic per second than a narrow road. For data transmission, normal microwave band for business service application can be broken down into 15 to 25 normal voice-band channels. Thus a criterion of potential practicality is the volume of communication—messages, data processing, transmission for control—for which the user must provide. This can be expressed in terms of numbers of voice-band channels required.

Obviously, volume potential and speed requirements must be extremely high. Economics of balanced computer loading may be an additional incentive, as was the case at North American.

One study of various communication media in a large utility—American Electric Power Service Corporation—indicates what might be expected. Here the company was licensed as a 'right-of-way' user, and repeater stations permitted transmission over long distances by successive 25-mile hops. The break-point came at about 8 channels (the power-line carrier system was saturated).

American Electric Power states: 'Although the power line carrier has been a reliable work horse, and with full appreciation of the excellent service provided by the communications common carriers, present requirements for channels both in quantity and quality are such that these means alone are insufficient. It is fortunate indeed that microwave has attained a level of development well beyond the experimental stage, and that rules and regulations of the Commission [already] permit its use in utility work'.

'This does not mean that it or any other system would be chosen to the exclusion of others, but rather that each will be exploited through what we consider the right of freedom of choice. . . . There is no question but that in times of stress and emergency, with either potential or actual



# WHAT IS MICROWAVE?

## *Short Wavelength*

'Microwave' is the name given to radio frequencies above 1,000 megacycles. The term 'microwave' itself designates very short wavelengths which, for practical communications applications, range from one foot to nine-tenths of an inch. For purposes of comparison, television wavelengths are on the order of 10 feet, and the centre of the standard radio broadcast band would represent a wavelength of 300 yards—athough wavelengths are ordinarily expressed in metres and centimetres.

## *Special Properties*

Microwave energy tends to follow the laws governing the propagation of light. It may be focused by means of a parabolic reflector which has the same contours as the reflector of an automobile headlight, but which is usually four or six feet in diameter. Microwave energy, instead of being carried by a wire line, is carried from the transmitter to the roof-mounted parabolic antenna through a hollow rectangular pipe called a 'waveguide.' The parabolic reflector directs the energy upward to the tower top where it is reflected in a horizontal direction by a metallic plane surface mounted at a 45-degree angle. The microwave energy travels across country to the distant receiving station in the form of a narrow beam. The receiving antenna system is identical to the transmitting antenna. After being reflected downward from the tower top the received energy strikes a parabolic antenna and is focused into the open end of a waveguide. The waveguide carries the energy to the receiver which is constructed on the same general principles as any superheterodyne receiver.

Since microwave energy is concentrated in the form of a beam, far less energy is required for successful communications than would be the case if the energy were broadcast in all directions. Only a tenth of a watt is sufficient to provide station-to-station communications over a microwave 'hop' of many miles when frequencies on the order of 6,000 megacycles are used. For the proposed higher frequencies the energy requirement would be less.

systems collapse, the entire cost of the communication system is justified if it stands up and gives continuous, complete, and accurate transmission of intelligence.'

Microwave systems will lend themselves to a wide range of types of data transmission. Thus Motorola are currently installing a microwave system for the Denver and Rio Grande Railroad. This will handle high-speed facsimile information between facsimile scanners and facsimile printers on their entire system. There are to be seven facsimile stations on this microwave system, handling information across the Rockies. The high-speed facsimile channel is limited at the present time only by the mechanical scanning and printing capacity of the associated facsimile equipment. This type of facsimile equipment is currently handling railroad weigh bills at the rate of 15 (eight and a half inches by 11) sheets a minute.

*3—Reliability*

Reliability of data transmission is a matter of over-all systems design, and will not be affected by the specific mode of transmission—*ie*, microwave *versus* telephone voice circuits, etc.

It is characteristic of a well-engineered multiplexed microwave system that the subcarrier channels are not subject to mutual interference. Equally important, interference from induction fields does not occur with a microwave beam as may happen in wire line installations. This will be of considerable importance in many data transmission applications. Furthermore, in data transmission systems which cannot tolerate any lost time at all, standby equipment at repeater stations will provide for instantaneous switch-over in the event of component failure.

## 44 Million Words Per Day

At Rocketdyne the computer network shuttles back and forth between Los Angeles and Canoga Park at an average of 50 tape reels a day, and each tape can contain up to one million words. Present average use is 44 million words daily. The equivalent information would occupy 454 miles of punched paper tape.

How effectively Rocketdyne combines data transmission and processing is shown by the preparation of the monthly budget control report. Data on all cost factors are microwaved to the Los Angeles division, where the job is processed on one of the IBM 705's. (Rocketdyne's two 709's at Canoga Park are used primarily for scientific computation.) The 705's magnetic tape data are then microwaved back to Rocketdyne. Final figures are read into a cathode ray tube unit, where they are photographed at the rate of 16 pages per minute. The filmed graphs are then enlarged, bound into book form, and delivered to management the following day. In twelve minutes, a computer produces 200 graph reports, which show management the budget situation of every Rocketdyne project.

Parts information is another example. The production status of thousands of parts required in Saturn, Atlas, and Thor engines is stored in an IBM Ramac 305, at Los Angeles. Any of this information is available in minutes on demand by any Rocketdyne location.

Since the Santa Monica Mountains preclude line-of-sight transmission between the two divisions, data from Rocketdyne are first beamed to a microwave dish located on Oat Mountain nine miles away. From there they are instantaneously relayed to the Los Angeles division adjacent to the International Airport.

Rocketdyne makes use of long distance data transmission in still other ways. Through a leased wire, cryptographic transmission system, the Canoga Park Computing Centre exchanges information with Rocketdyne test stands at Neosho, Montana, and at the propulsion field laboratory in the Santa Susana Mountains. Recently, another link went into operation—to the company's plant in McGregor, Texas. The company plans by autumn this year to extend the network to test stands at Edwards Air Force Base. There Rocketdyne engineers are preparing to test F-1, a huge single rocket engine with a mammoth thrust of one-and-a-half million pounds.

*Note: Appreciation for information on which this article is based is expressed to International Business Machines Corporation, Motorola Communications & Electronics Inc., Collins Radio Company, American Institute of Electrical Engineers, and Radio Corporation of America.*

## MICROWAVES FOR BUSINESS IN BRITAIN

The General Post Office is responsible, within the United Kingdom, for the provision of land-line communication facilities and for the allocation of frequencies and licensing of radio users.

Because of the relatively small area of the British Isles there is greater difficulty with interference between users on the same radio frequency than in the USA and, in addition, there is great pressure from all sides for channels in the appropriate frequency spectrum. Consequently, the availability of channels (and hence licences) is severely limited.

However, in appropriate circumstances, the General Post Office can provide suitable broad-band private circuits to cater for requirements similar to those mentioned in this article. These circuits are, of course costly but, where the necessary line plant is available or can be made available, circuits with band-widths of, for instance, 24, 48 or 96 Kc/s and even up to 3-4 Mc/s can be provided on rental.

# TRAINING COURSES

**ACTON**
**BRUNEL COLLEGE OF TECHNOLOGY**
**Department of Mathematics**
Advanced Mathematical Programming: 12 sessions (E): £1: 27 September.

**BRIGHTON TECHNICAL COLLEGE**
**Electrical Engineering Department**
Pulse Techniques and Magnetic Storage Devices: 12 sessions (E): £2: 28 September.

**DONCASTER TECHNICAL COLLEGE**
**Mechanical Engineering Department**
2-day Conference: 'Preventive Maintenance': 8-9 November.
3-day Conference: 'Principles and Applications of Method Study': November.

**Electrical Engineering Department**
A series of 24 lectures on 'Modern Developments in Electronics': 29 September.

**LANCASTER COLLEGE OF TECHNOLOGY COVENTRY**
**Department of Mathematics**
Office Organisation and Method: fortnightly (E): £1 2s.: 30 September.
Preliminary Course in Computing and Statistics: 34 sessions (D): 19 September.
Course in Mathematics, Computing and Statistics: 34 sessions (D): 20 September.
The Programming of Digital Computers: 12 sessions (E): £1 2s.: 28 September.
Advanced Course in Numerical Analysis: 26 sessions (E): £1 2s.: 19 September.
Linear Programming: 10 sessions (E): £1 2s.: 4 January.
Statistical Method: 31 sessions (E): £1 2s.: 22 September.

**MANCHESTER COLLEGE OF SCIENCE AND TECHNOLOGY**
**Department of Industrial Administration**
Operational Research: 22 sessions (E): £3 3s.: 19 October.
The Analysis of Manufacturing Operations: 30 sessions (E): £3 3s.: 4 October.

**RUTHERFORD COLLEGE OF TECHNOLOGY**
**Department of Mathematics**
Instrumentation and Automatic Control: 12 sessions (E): 18 October.
Analogue Computer Techniques — Introductory Course: 10 sessions (E): 29 September. N.B. This course will be followed by an advanced course in January, 1961.
Introductory Principles of Statistics: 24 sessions (E): October.

**SOUTHALL TECHNICAL COLLEGE**
**Department of Electrical Engineering**
Digital Computers: 12 sessions (E): £1: 27 September.
Practical Numerical Analysis: 24 sessions (E): £2: 28 September.

**KEY**

D Part-time day course
E Part-time evening course
R Full-time residential course
F Full-time non-residential course

## The Harrogate Conference—*continued from page 21*

sold and over-simplified. The difficulties still brittled: the meaning of accountancy terms such as 'post,' 'invoice' and 'balance' varied between firms (while a machine language standardises the meaning given to words); it would still require concentration to understand the syntax and grammar of 'computer English'; and no (commercial) easy language would remove the need to do lengthy (and expensive) systems studies before formulating statements.

I have to confess that I could spend only a day and a half out of the three in Harrogate, but the sample of the conference that I took away with me made me wonder how useful the formal sessions were. Apart from the contributions referred to above and two excellent reports on computer developments in the USSR and the USA, nothing that I heard sent me rushing to the notebook. Almost certainly, the place to outline something like 'an integrated system of clerical procedures on a low-priced computer' is not a conference—unless the integrated system is of startling originality. Looking at the programme for the conference one gets the impression that the organisers were most anxious to give the various computer manufacturers 'equal time' and this may explain why, on the commercial side contributions never rose above the 'we-did-it-this way' level. I missed this year the touch of realism that was provided at the 1959 conference by Mr J A Goldsmith, reporting on computer failures and the computer applications most frequently favoured in 1958-59. But then I suppose someone may have complained (quite wrongly) that this queered the manufacturers' pitch, and was not to be repeated.

*Basic to the new system are punches and encoders such as this electric punch used to mark account numbers in a complete book of vouchers or slips. Cummins have developed a wide range of encoding equipment suitable for a variety of needs*

# *An Alternative to MICR*

**Faced with the problem of coding their documents so as to be able to automate their biggest clerical chore—document sorting—American and British banks chose magnetic ink character printing and reading, as this had the advantage that what could be read by machine was also legible to the eye. Now a new 'dual purpose' code (and associated equipment) offers a cheaper alternative to MICR, for companies with similar problems**

RECENT endeavours by companies to streamline their clerical work have followed the now familiar paths of examining — and eventually buying — electronic systems or even up-to-date punched card equipment. Such electronic systems, because of their capabilities and the speed at which they work, tend to highlight those areas of clerical work which cannot so *obviously* be automated. For example, the speed at which modern card readers flick through packs of cards begs the question, 'who will punch the cards initially?' The fact that a high-speed reader can dispose in a minute of as many cards as one operator punches in three hours adds point to this.

Consequently, there is now a move to put the 'source data' of any transaction in a form which will make it readily usable in electronic (or electro-mechanical) data processing systems — particularly where very large quantities of transactions are involved in hire purchase businesses.

To a very large extent it is the problem of 'source data' that has handicapped the big banks and prevented them from adopting mechanised procedures. The banks jibbed at giving us cheque books composed of punched cards. (These might have held such information as branch number and customer's code number gang-punched into a book of cards.) Instead they preferred to wait until magnetic character printing and reading was developed, so that their source documents — *ie.* cheques — would remain unchanged. Still, magnetic character reading is clearly a solution to the problem of preparing information *as soon as possible* in a form directly or indirectly suitable for large-scale mechanised processing. Another solution — though not, of course, for the banks — is provided by the Kimball ticket system (see the October, 1959, issue of AUTOMATIC DATA PROCESSING).

In the USA the Cummins-Chicago Corporation have developed a family of equipment which represents an entirely new approach to the task of 'automating from the beginning.' As this equipment is to be marketed in Britain through the Corporation's British agents, K S Paul (Printing Machinery) Ltd, firms in this country will soon be able to examine this system which eliminates some of the manual stages in a data processing operation.

Basic to the Perf-O-Data system is its 'dual code.' Just as printing characters in magnetic ink serves the dual purpose of making it possible for both a man and a machine to read what is printed, so does the code developed by Cummins. Documents are coded with perforations — in the same way that blank paper tape is coded — but these perforations differ in that they form legible digits. Thus the dual code combines a standard, five-channel in-line code with legible perforated digits. [The in-line code can be used for those portions of the information that either do not need to be read visually or are repeated on the document as printed characters.]

A comparison between the digit reading pattern and the in-line reading pattern shows there

*This document sorter reads and sorts perforated digits on documents at the rate of 550 documents a minute. Cost: about £7,000*

is little difference between the two cards: the digit reading pattern is nothing more than the five-channel in-line pattern spread over three columns instead of being confined to a single vertical column.

As a machine language the dual code has a number of advantages; apart from the obvious one that once documents have been encoded no extra operation is required:

—repetitive information can be punched into up to 20 documents at a time.

—it has as high a reading accuracy as any machine language.

—it has a low reject rate.

## The Equipment

Around their 'dual code' Cummins have developed a variety of equipment. However, there are three principal machines which are basic to any Perf-O-Data system:

1—the coder or punch

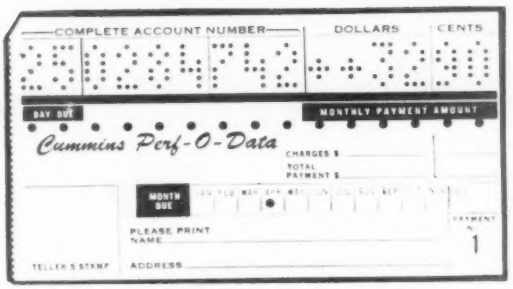
2—the sorter

3—the reader

Cummins have developed a number of machines for encoding documents: these range from simple lever-setting and handle-cranking encoders to electrically-powered gang punches capable of encoding 20 documents simultaneously.

The Cummins sorter reads and sorts from either perforated digits or in-line code and handles a variety of different-sized documents at the rate of 550 a minute. Alternatively, the sorter can be used as a sorter-reader, which enables documents to be sorted at the same time as the information they contain is read to actuate card or tape punches.

*The photo-electric reader automatically picks up perforated information on documents at a very fast rate. Its speed, however, is limited by that of the intercoupled device used—a card or tape punch*




*Sample (reduced considerably) of a monthly payment chit with perforated digits*

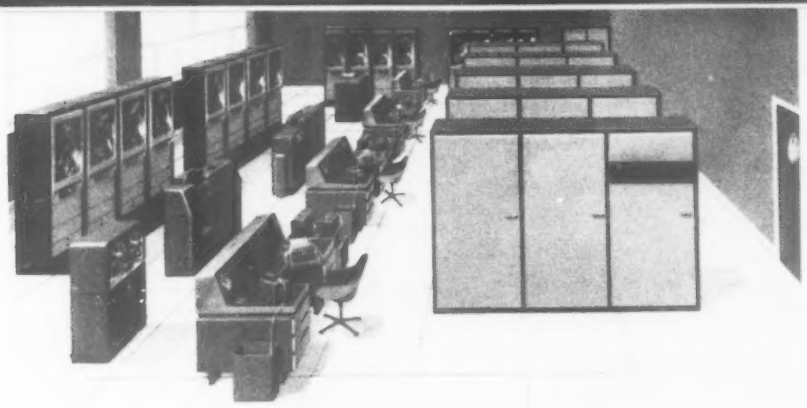
The reading equipment is primarily designed to convert, at high speed, information in dual code to punched cards or paper tape which can then be used on conventional card or computing equipment. The photo-electric reader can read from 400 to 10,000 legible perforated digits or 1,600 to 40,000 in-line figures a minute; however, actual reading speeds are governed by the maximum operating speed of the intercoupled tape or card punch, or electric lister.

Cummins' new system was developed with particular types of businesses in mind: hire-purchase organisations, American banks and organisations that receive regular payments, such as mortgage payments.

One American bank, the Central National Bank of Chicago, has already installed Perf-O-Data equipment. A medium-sized bank, which handles 80,000 to 100,000 cheques a day, it previously found that it took as long to sort its daily crop of cheques as to post them. The sorter, segregating at the rate of 550 cheques a minute has considerably changed the picture.

One interesting fact about Central National's new system is that cheques arrive in its Chicago offices that may have been processed for distribution, by the correspondent and Federal Reserve Banks from which they come, on equipment which reads characters printed in magnetic ink. So the two systems—magnetic character reading and perforated code reading—are not mutually exclusive. This is a fact that might interest the smaller banks in Britain who will never be in the MICR class because of the cost involved (a MICR sorter is likely to be four times more expensive than the Cummins sorter) but who still want to automate.

Possible applications for Perf-O-Data systems in Britain might be in rental and hire-purchase businesses: the idea of giving each instalment payer a book of tickets which would contain in dual code his account number and the amount he was to pay—(this would be gang-punched) might well appeal to those organisations anxious to dispense with manual recoding systems.



*An artist's impression of an Atlas system*

# *The Shape of Atlas to Come*

**Features of the giant computer Ferranti are currently building which will be the second fastest system in the world**

FERRANTI'S new digital computer, Atlas, which is being developed in Manchester University by a joint team of Ferranti engineers and university scientists (headed by Professor Tom Kilburn) will operate at a speed approaching that of light.

The computer will be a hundred times faster than the fastest existing European computer, Mercury.

The speed and flexibility of the computer is brought about by technical advances in fast-carry adder techniques and by a rapid access fixed store.

The normal computing store will be a form of ferrite core store employing two cores per bit. Each section of 4,096 words will operate independently with a cycle time of 2 microseconds; thus, by using several sections, a mean access rate of over a megacycle is achieved (consecutive addresses appear in different sections). The average time to extract and execute a complete, single-address, floating-point addition instruction is expected to be 1.1 microsecond, but the actual time will vary depending on the amount of possible overlap with adjacent operations. The effective speed of multiplication is such that, for example, summing a polynomial will take from 5 to 7 microseconds per term.

In the fixed store information is represented by the presence or absence of ferrite slugs in a woven wire mesh, and the cycle time is approximately one-fifth of a microsecond. This high speed enables many simple subroutines to be executed in times not much greater than those for some of the basic instructions, and the design is such that these subroutines are in every sense an extension of the basic instruction code. One bit in the function of every instruction indicates whether the instruction is basic or "Extracode" (*ie.* to be interpreted by a fixed store routine). In the latter case the rest of the function part determines the entry point to the fixed store routine and the address part is available for use as a parameter. The format is thus exactly the same as that of a basic instruction.

The fixed store also contains routines for initiating and controlling external transfers, for monitoring programs, for carrying out simple routine engineering tests, and for operating time-sharing between programs.

The word length is 48 bits. Numbers are represented in floating octal, with 8 bits allocated to the exponent. An instruction occupies a whole word, with 10 bits for the function, 7 bits for each of two 'B' or index addresses (arithmetic instructions can be double-modified), and 24 bits for a single main store address. This generous allowance of instruction bits caters for the many developments of the system that are likely to occur in the future.

The most revolutionary feature of the machine concerns the manner in which the address digits are interpreted (after being modified by the addition of indices if appropriate). The store is regarded as being composed of blocks of 512 words each. Thus, 9 of the address bits determine the position of a word within its block, leaving 11 bits to identify the block. However, these 11 bits do not define directly the physical position of the block. Instead, each block is identified by an 11-bit floating label which is independent of its actual position.

With each 'page' or block position in the core store there is associated a 'page address register' to hold the label of the block which happens to occupy that page at any moment. Before every store access (whether for instruction or operand) all of these registers are consulted simultaneously and very rapidly. The register whose contents agree with the required block number responds to this enquiry, and its page is then used in the transfer. The consultation of the page address registers is done by special circuitry and does not limit the rate of transfers to and from the store.

Currently the design envisages a core store of 16,384 words as a minimum, which may be increased in units of 4,096 words; up to 16 magnetic drums each holding 24,576 words; up to 32 magnetic tape decks communicating via 8 channels, each handling 90,000 characters per second; up to 8 line printers operating at 600 lines per minute; together with card readers and punches, punched tape readers and punches, xerographic printer and graphical display.

# *CONTROLLING MAINTENANCE STORES*

*continued from page 24*

computer verifies that the line number as recorded on the document by the storekeeper is in sequence and is, in fact the nmber immediately following the one previously stored. If the document passes this check (and also others imposed at this stage) the computer updates all the stored information. This causes the line number to be increased by one and the same check is then imposed on the next document. The main object of the line number check is to indicate missing documents.

The quantity balance remaining in stock after the execution of the last transaction is stored in the computer in two forms: as quantity valued and as quantity unvalued.

Before processing a receipt document, the computer adds the quantity, as recorded on the document, to the total of the quantity balances stored in the computer. For an issue, the quantity is deducted.

The computer then checks that the quantity remaining in stock, as calculated, agrees with the documentary record. If the valued quantity in stock, according to the computer record, is sufficient to permit the transaction, but the document otherwise fails to pass the balance check, then the document is processed and the balance error is printed out. Should the computer record show the valued quantity in stock to be insufficient, the document is rejected.

## Documents from the storekeeper

Other checks, to be described later, are applied in certain circumstances. There are certain discrepancies which the computer has been programmed to accept. In such cases, in spite of the document having failed a check, it is processed and the computer prints out the apparent error in sufficient detail to permit investigation and corrective action. Similarly, there are disagreements which the computer has been programmed to reject and to print out the reason for the rejection in enough detail for managerial action.

It will be apparent that the computer works in a simple logical routine, which is determined by the storekeeper by means of the documents he initiates. Irregularities are printed out for investigation, and in order to obviate superflous printing out, it is necessary for the storekeeper to document and post transactions in the sequence in which they occur.

The storekeeper prepares the stores documents from which the information is punched in paper tape, and these are then passed to the stores accounts department.

The documents are: (1) controlled stores received note; (2) stock order receipts; (3) controlled stores return to stores; (4) controlled stores transfer note; (5) controlled stores issue note; (6) controlled stores issue note (associated companies); (7) controlled stores returned note; (8) adjustment note; (9) static data advice.

The receipt of controlled stores from a supplier is recorded on a 'controlled stores received note', a multi-line document that permits the recording of up to six items, but only items from one supplier, in one consignment against one purchase order, are recorded on one note: otherwise, each item has a separate note. Items of the company's own manufacture are recorded on a stock order receipt as they are delivered. When it is necessary to receive back items which have been issued from stores, these are recorded on 'return to stores' documents.

A 'controlled stores transfer note' is used to record both the transfer to the receiving store and the issue from the issuing store.

Stores issued to the company's maintenance departments are recorded on a 'controlled stores issue note', which holds 20 issues, thus easing the filing problem. When issued to associated companies, a special version of this note is used.

If an item, once issued, is found to be defective, it is first returned to the stores and then to the supplier, details being recorded on a 'return to supplier' note. A 'material transfer note' records the transfer of materials to another sub-store.

New materials are allocated material code numbers on receipt at the store. The storekeeper records the code number, control levels and unit of quantity on a 'static data advice'.

Controlled stores received notes are kept in the accounts department in alphabetical order in four files:

1 – *unvalued and unprocessed* stores received notes;

2 – *valued and unprocessed* stores received notes;

3 – stores received notes *processed for quantity only*;

4 – stores received notes *processed completely*.

After each state of processing the 'stores received notes' are endorsed with a code and week number to indicate the stage of processing. The codes are:

Reed's computer department serves the 20 companies that comprise the group, and has in fact taken over the function of a central data processing department which previously operated electro-mechanical punched card equipment

UG processed in respect of quantity only;

GV processed in respect of value only, having already been processed as unvalued;

GR processed in respect of quantity and value simultaneously.

The stores accounts department checks all 'stores received notes' to ensure that they have been correctly entered by the storekeeper, and then files them until the arrival of the corresponding suppliers' invoices, when the stores received note number is entered on the invoice. The invoice is then passed for payment authorisation and, on its return to the stores accounts department, is filed with the stores received note, which is now valued.

At the end of each week, before the weekly processing, all stores received notes remaining in File 1 (unvalued and unprocessed notes) are scrutinised to ensure that no entries have been made by the computer department in the 'amount' column. The documents are then counted and sent to the computer department with a note of the quantity despatched on an advice note, a carbon copy of which is retained in the stores accounts department for checking when the documents are returned.

After processing in the computer department, the unvalued stores received notes are endorsed 'UG (week number)' and returned to the stores accounts department. There they are filed with other stores received notes processed for quantity only, to await the suppliers' invoices.

The valued and unprocessed 'stores received notes', with their related invoices, are prepared at least once a week for posting to the purchase and nominal ledgers, when the stores received notes and invoices are separated and both batches add-listed to give an agreed control total. At the end of each week the batches of stores received notes are sent to the computer department with their related control totals recorded on advice notes. When processed in the computer department, the stores received notes are coded 'GR (week number)' and returned to the stores accounts department.

This conversion unit enables Reed to punch out on to paper tape information stored in magnetic film files as an off-line operation

All stores received notes which have been processed for *quantity only* are coded with the letters UG and the week number. After they have been linked with their related invoices, they are placed in a separate section of File 3, (notes processed for quantity only), which is cleared at least once a week. The stores received notes and invoices are then separated and add-listed to obtain a control total. At the end of each week the stores received notes are sent to the computer department for processing. After processing, they are coded 'GV (week number)' and returned to the stores accounts department for filing.

When all stores received notes have been processed completely they are filed permanently for future reference. If an additional debit or credit note is received subsequently, an adjustment note is made in the stores accounts department, posted in the storekeeper's ledger for a line number, and passed to the computer department.

Errors (chiefly of a simple clerical nature) in the storekeeper's ledger are corrected without taking up an additional line in the ledger and are not documented, so that eventually there is no disagreement with records held in the computer. All other adjustments affecting the data stored in the computer are documented and entered in the storekeeper's ledger on consecutive lines. Every adjustment is recorded on an adjustment note. In most cases the adjustment is likely to be necessary as a result of a discrep-

# *CONTROLLING MAINTENANCE STORES*

*continued from page 24*

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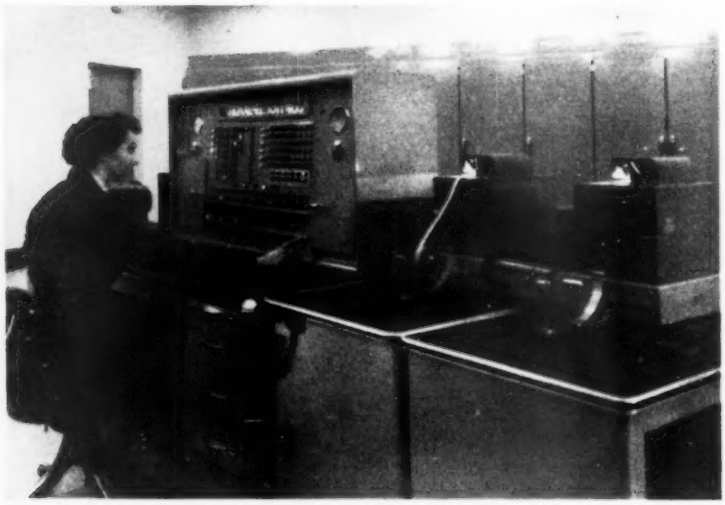


With their stores control programs Reed hope to save £20,000 annually

ancy between the storekeeper's ledger and the computer. Normally the resolution of these discrepancies is the responsibility of the stores accounts department in collaboration with the storekeeper.

## The output

The computer produces data on paper tape (in the case of bulk output) or on magnetic film from which the data are subsequently transferred to paper tape in an off-line operation. This tape is then fed into printers, which produce the various output schedules in triplicate. One copy is retained in the computer department and the other two are distributed to the appropriate departments.

For programming purposes the schedules are given type numbers. There are eleven types: statement of transactions, analysis of material issues, quantity balance at or below minimum level, quantity balance at or below order level, quantity balance above maximum level, extraordinary purchase prices, balance discrepancies, missing lines, unposted-excessive missing lines, unposted-duplicate line numbers, and unposted-other causes.

Each statement of transactions shows the value of the opening and closing balances held in the computer ledger and the value of receipts and issues, by document types, of documents processed by the computer. These statements of transaction are reconciled once a week in the stores accounts department.

The analysis of material issues shows the value of each issue from stores and each return to stores, as calculated by the computer. Costs are shown under various expense and cost headings.

The four output schedules produced as a result of the control procedures carried out by the computer are: quantity balance at or below minimum level, quantity balance at or below order level, quantity balance above maximum level, and extraordinary purchase prices. In each case the schedule printed out by the computer calls for executive action and investigation.

Five schedules are produced as a result of the discrepancies between the record in the computer and the record in the storekeeper's ledger. They are: balance discrepancies, missing lines, items unposted — excessive missing lines, items unposted — duplicate line numbers, and items unposted — other causes. The information shown on any of these schedules should be enough to indicate likely causes of the difference where information relating to a commodity appears on more than one of these schedules, as may happen frequently, it should be possible to locate the error by taking the information as a whole.

Documents which fail to pass the balance remaining check and simultaneously cause an alteration to the stored balance error are stored during each posting run for subsequent printing. Balance discrepancies may be caused by an incorrect entry on the document, or a missing document immediately preceding the one on which the discrepancy occurs. The missing document may not have been sent to the computer department or it may have been rejected by the computer. In either case, the fact that a document is missing is shown by the schedule of missing lines. Also, if the missing document has been rejected by the computer the fact is shown on one of the schedules of unposted documents.

## Balancing acts

The results of attempting to correct an error are also shown on the schedule of balance discrepancies. When the attempt is successful, the final state state of posting for the week is printed, showing '0' in the error column. When the attempt is unsuccessful the adjusted error and final posting state are given.

Progressively during each week, the various documents are received in the stores accounts department. Control is kept by recording the document reference numbers of each type of document and by checking their continuity. Each document is then examined to ensure that all the necessary information has been clearly entered in the correct places.

All errors and rejected documents are investigated immediately on receipt of the output schedules of discrepancies, and adjustment notes are prepared and, when appropriate, approved by the accountant.

# WHAT'S NEW

in systems, services and equipment

## Business Television

CLOSED-CIRCUIT Television is continually being applied to new business uses particularly in the field of communications.

Pye are marketing a flexible group of units called the Mark IV. Basically it consists of three parts: a camera head, a camera control unit and a camera control panel. To complete the closed circuit, either a video or RF picture monitor is required. The picture may, of course, be displayed on a number of such monitors located at a considerable distance from the camera position.

The Mark IV equipment has been planned on the building brick or meccano principle that is to say, it is possible to add certain remotely controlled facilities on to the basic system if it is found that they are needed. For instance, the camera unit has provision for manual adjustment of optical focus. If an installation calls for remotely controlled optical focus, then the appropriate attachment providing this facility can be fitted to the face of the camera. If a choice of lenses is found to be desirable, a lens change attachment may be added which will allow for the remote selection of one of two lenses giving two different fields of view. Other facilities include, remote iris control, remotely controlled zoom lenses and remotely controlled pan and tilt. All the circuits feeding these additional units are included in the 28-way camera cable.

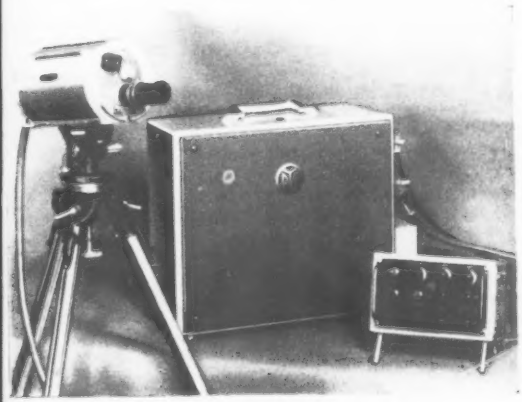
The camera unit consists of a small cylindrical camera with a flat lower side into which are tapped a number of fixing holes by means of which the camera may be attached to a tripod or other support.

The single 28-way camera cable should not exceed 1,000 feet.

The camera control unit has been designed to serve any of the varying camera units and attachments. It consists of a video processing amplifier producing a standard output wave form scan generating circuits for the camera, a timing generator of the binary type providing for accurate interlaced scanning and a circuit which allows the camera to adjust itself automatically to varying scene illumination.

The camera control panel carries all the operating controls. It is an entirely separate unit and may be located up to 1,000 yards from the camera control unit, to which it is connected by cable of half an inch diameter.

For further details tick HO1 on the reader enquiry coupon on page 43, or write to:
*Pye Ltd.,*
*Industrial TV Division,*
*9 Upper Berkeley Street,*
*London, W1.*



### Message Centre for 'Time'

AN electronic message centre, the Dynasort, has been installed in the offices of *Time* Magazine, New York. Main objective of this new installation, which looks like a cross between a linotype machine and a cinema organ, is to sort incoming messages and route them automatically to the appropriate editorial desk, a job which formerly occupied nine full-time clerks, working with 32 different lists.

The complication of the job lies in the nature of many of the messages received. A Washington Press bureau message may have twenty-five to thirty separate items; each item may affect three or more different editorial desks — a President's Press conference, for example, usually covers national affairs, politics, foreign affairs, business, and other categories as well.

Establishing the categories is the only all-human application. Thereafter the subjects listed are coded on the console of the Dynasort and the message is passed to the cable distribution chief. He presses the appropriate buttons on the machine, bringing the electronic memory into action; in seconds he knows the number of copies required, and is thus able to send the duplicated master to the duplicator. When copies are returned, he has only to press buttons which light up the appropriate slots in the three-tier distribution rack which is situated at the machine's side. And then put the copies in each lighted slot and the job is done.

*Time* say that the installation will have paid for itself in fifteen months, and that in addition flow-through of cables and wires — which average about 40 messages an hour — has been considerably speeded. More Dynasorts are on order, and Burtonwood Engineering Co, U S Industries Inc's English associates, hope to install one of them in the U K before long.

For further details tick HO2 on the reader enquiry coupon on page 43, or write to:
*U S Industries Inc*
*(Great Britain) Ltd.,*
*New Bond Street House,*
*1-5 New Bond Street,*
*London, W 1.*

### For Rapid Access to Cards

AN operator sitting comfortably at the electrically operated Rolstar desk has immediate access to any section of index cards without bending or stretching.

The Rolstar is available for housing from 5,000 to 60,000 cards and is constructed to cater for all sizes of cards. Existing cards and folders can also be used. Records

may be filed alphabetically, numerically, by geographical location or in any way to suit the needs of a particular organisation.

Based on the rotary principle, this fully-mechanised unit is designed to give total visibility and speedy reference to any card and enables one to file the maximum number of cards in the minimum space.

Cards of up to six inches high are contained in cabinets which contain eight trays rotating round the wheel. Almost noiseless in use, the Rolstar can be rapidly converted for operation by hand in the event of a power failure.

The cabinets measure 48 inches high and are 56 inches from front to back.

Prices range from £207 10s. to £228 5s. according to size.

For further details tick HO3 on the reader enquiry coupon on page 43, or write to:
*E. N. Mason & Sons Ltd.*
*Arclight Works,*
*Colchester,*
*Essex.*

## Control Panel Simplification

A SIMPLIFIED and flexible control panel wiring system, the G C Panellogic, which will reduce plug board wiring costs on punched card installations, was announced recently. A G C Panellogic kit comprises all tools and materials needed for most types of plug board. The different wire colours allow for complete colour coding. Wiring can then be traced visually, and tested and checked for terminal posts, without removing wires from the panel or the panel from the machine. More compact plugboards can be achieved by this system—it is claimed—since the hand tool provided allows wires to be cut and connected in exact lengths.

For further details tick HO4 on the reader enquiry coupon on page 43, or write to:
*Punched Card Accessories Ltd.*
*Abbey House,*
*Victoria Street,*
*London, S.W.1.*

## 'Cool' for Square Roots

A NEW desk calculator designed to assist architects, engineers and surveyors was recently announced by Bulmers. The notable feature of this calculator, the Friden SRW, is its ability to extract square roots automatically.

The square root unit operates by setting up the radicand on the keyboard; at the touch of a key the square root appears on the dials, and the root thus obtained can be retained in the machine for further use. The SRW also handles automatic multiplication, automatic division, accumulative multiplication (for which it has the split upper dial feature), and has other characteristic features of Friden calculators, such as the automatic decimal point positioning and keyboard lock.

The SRW costs £660. Special rates are available to technical colleges and educational establishmnts.

For further details tick HO5 on the reader enquiry coupon on page 43, or write direct to:
*Bulmer's (Calculators) Ltd.*
*Empire House,*
*St. Martin's-le-Grand,*
*London, E.C.1.*

## New Automatic Collator

A MACHINE which may well be adapted to serve the needs of tabulator plain language output feed is the new automatic collating unit, the Gathermatic.

The Gathermatic allows for the collating of paper from 12 stations, with a mechanism for cutting out any station if desired. Each station is able to accommodate half a ream of paper from three inches by five to 11 inches by four, and loading can be carried out in less than a minute on all 12 stations.

A delivery rate of 6,000 sheets per hour is maintained and the automatic stacker assembles finished sets in criss-cross fashion. An automatic stacker can also be added to the machine and synchronised with its operation.

The machine is equipped with error-detection equipment, a miss-detector and double-sheet detector being incorporated; the evidence of an error stops the machine automatically so that the operator can make corrections without having to check the set to see how it is deficient.

For further details tick HO6 on the reader enquiry coupon on page 43, or write to:
*Gordon and Gotch Ltd.*
*75-79 Farringdon Street,*
*London, E.C.4.*

## Time-sharing for Dictators

A METHOD of allowing for maximum time-sharing of recording equipment in a typists' pool, and which ensures that each dictator's work is clearly distinguished (by the use of self-contained detachable coloured magnetic discs, each with a running time of twelve minutes) is announced by Rex Business Machines.

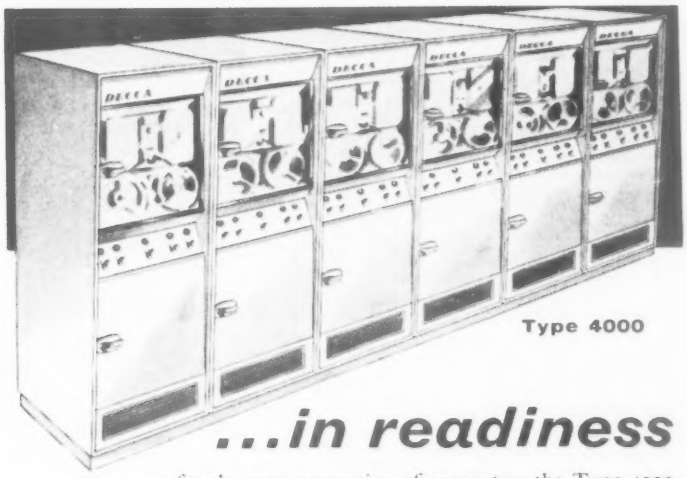
The main advantage of such a system is that the dictator can use the existing internal telephone system of an office—thereby saving installation costs. Also it means that the system does not suffer from the limitations of the separately wired system whereby it is difficult and costly to expand on the number of dictating points available.

Under this system the dictator telephones a pre-determined number on a receiver wired to the PAX (private telephone exchange) system. The PAX automatically hunts and finds the first free dictation unit in the pool, whose operator answers, and then presses the 'dictate' button. The dictator then controls the disc recording apparatus through his telephone. When he taps the receiver plunger once the machine will immediately start recording, and this is indicated by the cessation of the 'tick'—a subdued equivalent of the dialling signal of an external telephone. When this ceases, the dictator knows he is recording; when it resumes he knows that the machine has stopped. He can also stop the recording by tapping again on his plunger.

The usual 'code' for calling the operator will be a single digit-dialling. The play-back code will be a triple-digit dialling, and the recall of the operator can be brought about by dialling another pre-determined number. Dictation is concluded by the dictator replacing his receiver on the stand. This will transmit a visual and audible signal to the operator. She will immediately change the disc and clear the unit reader for the next dictator.

Direct access facility for very busy executives is allowed for by fitting a key-controlled device under the telephone, thereby directly connecting the executive to the Rex units in the pool. This allows for a 'hold-dictation' switch to be operated to permit incoming telephone calls. Another

# DECCA magnetic tape systems



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for the next generation of computers the Type 4000 Tape Unit, embodying many novel features, is already in the advanced stages of development.

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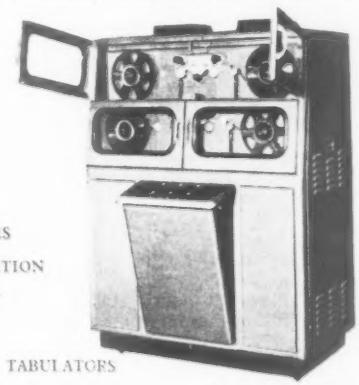
UNIVERSITY MATHEMATICAL LAB., CAMBRIDGE



Type 3000

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DECCA RADAR

*For further information, please write to:*
DECCA RADAR RESEARCH LABORATORIES
Hersham Trading Estate, Walton-on-Thames, Surrey
DR135A


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A great deal of information comes into the offices of AUTOMATIC DATA PROCESSING. Unfortunately we cannot publish all. But we retain everything—in files, on cards and in our heads. When queries arrive (on systems and products, books, courses, exhibitions, and even practical problems) we can usually provide an answer or find someone who can. Each month we publish in WHAT'S NEW the latest about new systems, services and equipment. We give below each item the address of the relevant company. But if you want further information and are too busy to write a letter, just fill in the coupon below.

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useful additional feature is a combined monitor and busy-out switch which enables the operator by pressing down a key, and using a change over switch, to change dictation from one machine to another.

For further details tick HO7 on the reader enquiry coupon on page 43, or write to:
*Rex Business Machines Ltd,*
*170 Tottenham Court Road,*
*London, W1.*

## Additional Storage Capacity

THE capacity and economy of the IBM 1401 data processing system can now be increased by the addition of a further 12,000 positions of core storage in blocks of 4,000. This brings the maximum total up to 16,000 positions.

Advanced characteristics of the 1401 storage, such as variable word length and alphanumeric representation, mean that this total capacity is equivalent to a substantially larger memory in systems that use more conventional types of storage.

For further details tick HO8 on the reader enquiry coupon on page 43, or write to:
*IBM United Kingdom Ltd,*
*101 Wigmore Street,*
*London, W1.*

## For book-keeping

A NEW direct entry accounting machine by National Cash, Class 34, intended to handle all book-keeping and accounting jobs, features flexibility of posting, provided by its seventeen registers. A program bar controls all types of posting and final totalling for each application and allows for the automatic printing of dates and final numbers, slip and reverse tabulation and carriage opening and closing. The program bar can be changed in a matter of seconds.

Balances and sub-balances are normally printed automatically, while an automatic machine lock can be used to draw the operator's attention to a credit balance. The machine can either provide separate or net accumulation of debit and credit balances, even when these are printed in the same column.

A reverse key allows posting errors to be corrected simultaneously on all registers affected by the false entry. Total keys enable totals or sub-totals to be printed in the same columns as the accounts, and transferred simultaneously to other registers for posting to control accounts. Features common to earlier models, the Class 31 and Class 32 are also incorporated, such as fluid drive carriage, the split platen providing independent control over vertical spacing each side, full amount keyboard and built-in electric typewriter keyboard.

For further details tick HO9 on the reader enquiry coupon on page 43, or write to:
*National Cash Register Co Ltd,*
*206-216 Marylebone Road,*
*London, NW1.*

## Radical Computer

A NEW computing system which —the makers claim—combines the simplicity and low operating costs of an analogue machine with the more sophisticated data storage, ease of input and output and accuracy of the digital computer was recently launched.

Claiming for their Radic a very much greater accuracy than conventional analogue machine, the makers are careful not to suggest their new system as a direct rival to the digital computer in payroll or sales accounting, requiring sophisticated and costly data storage techniques. But it is significant that a smaller version of Radic consisting of a digital memory unit, integrations and multipliers, is to be put on the market for specific office use.

The main applications of the system, it is suggested, lie more in the industrial field. Analysis of design and operation of steel mills; analysis, control and optimisation of process control plant design; pipeline analysis for the oil industry; braking and control systems for the motor trade; and a number of other applications in atomic energy, the aircraft industry and commerce generally.

The main advantage of the new system is that it allows for instanteous solutions to cover rapid production changes. The accurate simulation of time delays in industrial production is another valuable application, as well as statistical flow-line and systems analysis and linear programming.

The basic system consists of four main units, the main computer rack, the control desk, the digital memory unit, and the twin plotting recorder. The computer rack consists of the analogue computer units—direct current drift corrected amplifiers, electronic multipliers and diode network function generators. Backing up these elements are servo-operated electro-mechanical integrators and multipliers, and the unit also consists of a scanning system, and analogue digital and digital analogue converters; the inter-connection of these various elements is regulated by a central 'patchboard'.

The control desk consists of a modified Addo-X digital printer which feeds data into store and also prints out. There is also a co-efficient setting keyboard, for the automatic setting of co-efficients in the analogue computer elements. Also in the control desk unit are repeat analogue and digital monitors, and a two-channel pen recorder and a control panel.

The digital memory unit is perhaps the most interesting element of the computer. It works on the 'time quantizing principle', which is a wholly new concept. The unit consists of two tape decks, a digital encoder for translating input data into into a form suitable for storage, and a digital-to-analogue converter for translating digital data from the tape into a form suitable for the analogue computing elements.

In the new storage system the magnetic tape is sprocketed like a cinematograph film and thus moved in separate small steps, the digits being recorded and read out as the movements take place. Thus the steps are synchronised with the read in read out circuiting, the intervals between successive movements being extended at will. The electric pulse controlling the stepping action can be set at a constant rate or make its way in accordance with some other quantity involved in a computation. In this way the storage system can be used to simulate the delays which may occur in process control systems. The time delay facility can also be used for correlation computing.

The computer is 'built for growth' and its cost will range from £10,000 to £150,000. Delivery time is given as three to four months.

For further information tick HO10 on the reader enquiry coupon on page 43, or write to:
*Rediffon Ltd,*
*Gatwick Road,*
*Crawley, Sussex.*

# FRIDEN FLEXOWRITER

## does your sales order-invoicing automatically

**Speeds and streamlines work routines**
**Eliminates human errors**
**Saves time and money**

The FLEXOWRITER is an automatic machine which produces a code-punched tape as a by-product of writing the original document. This punched tape is then used to create other records automatically, eliminating the continuous manual reprocessing of data that runs up office costs.

For example, the punched tape produced as an automatic by-product of a sales order automatically prepares the sales invoice, and punches cards for statistical reports. Purchase orders, goods received notes and many other records may be prepared with similar advantages.

The FLEXOWRITER may be installed one at a time, in multiple units or in connection with auxiliary equipment, thus greatly expanding its applications.

The choice of a FRIDEN FLEXOWRITER as the basic unit in an automatic office opens the broadest opportunity for continued extension of automation. Start with one FRIDEN unit, then add others as each pays for itself.

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LEO Computers Ltd. is about to expand its Research, Design and Development teams in order to extend and diversify its activities in the computer field. Men who are keen to work in a stimulating environment with outstanding prospects for rapid advancement are invited to apply for positions where they will be able to make a substantial contribution towards the success of our activities.

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★ Successful applicants will be offered positions, on the monthly staff at Intermediate or Senior level according to previous experience and qualifications (from H.N.C. to advanced degrees).

★ Quarterly assessments of progress will allow the able man to proceed rapidly to the high income range.

★ Some financial assistance towards the cost of removal to the London area will be offered where appropriate.

★ To those whose applications seem suitable, full descriptive literature will be sent with an invitation to meet Dr. Pinkerton, Research Director, at our laboratories in North-West London.

★ Write giving details of career to:

**Personnel Manager, LEO Computers Limited, Hartree House, 151A-159A Queensway, London, W.2.**

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Applicants should have previous experience with transistors in the computing or allied fields and should preferably be not less than age 25.

The position offers great scope to a successful circuit designer who now feels the urge to apply his conviction and experience outside the laboratory.

This is a key position in the electronic industry and the successful applicant cannot fail to make himself a master of his subject.

Written application should be sent to:

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## Systems Analyst

This vacancy is created as a result of the expansion of the Company's Procedures and Methods Central Office at Dagenham.

The successful candidate will be capable of examining existing clerical and mechanised systems and developing new procedures with the minimum of supervision. He will have several years experience in O & M work, a good general commercial background and will be familiar with punched card and/or computor techniques.

A university degree or similar qualification is desirable although preference will be given to applicants with an aptitude for work of this nature.

This is an excellent opportunity for a young man age 25-35. Salary will be commensurate with qualification and experience and promotion will be awarded on merit.

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## COMPUTER PROGRAMMES SUPERVISOR

To be responsible for the carrying out on the I.B.M. 7090 Computer at A.W.R.E. Aldermaston, programmes originating at the Research Establishment at Harwell or The Atomic Energy Establishment, Winfrith.

Applicants should have G.C.E. at 'A' level H.N.C. or equivalent qualifications and have digital computer experience. Knowledge of I.B.M. 7090 operation and programming an advantage.

SALARY: £1,045—£1,285 p.a.

The successful applicant, although responsible to the Research Group, will be based at A.W.R.E. Aldermaston where a house or other accommodation will be provided. Contributory pension scheme.

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The leader will have technical and administrative control of the Group. He should have good qualifications and considerable experience in the general field of Digital Data Handling.

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to be responsible to the Chief Engineer for specified projects from initial inquiry to final commissioning, including the preparation of specifications, planning of development, design and prototype work, control of supporting staff, and liaison with customers. Systems under development use transistors in precision analogue circuits, employ the most modern circuit techniques, and operate under severe environmental conditions.

The position offers considerable scope for career advancement to a person with an original outlook and natural design ability. Depending upon qualifications and experience, commencing salary will be up to £1,500 p.a.

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(a fully synchronised unit system)

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| *Card Reader Punch | 300 cards per min. |
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| *Programme Unit | |

All the elements are linked through the programme unit which co-ordinates the whole system and enables parallel processing of data.

Input-output speeds may be doubled by the addition of further units.

A second programme unit can be attached, increasing programme possibilities and enabling even further expansion of input-output units.

The 300 DP Series will expand into an electronic system with the incorporation of one or more of the following units, as required:

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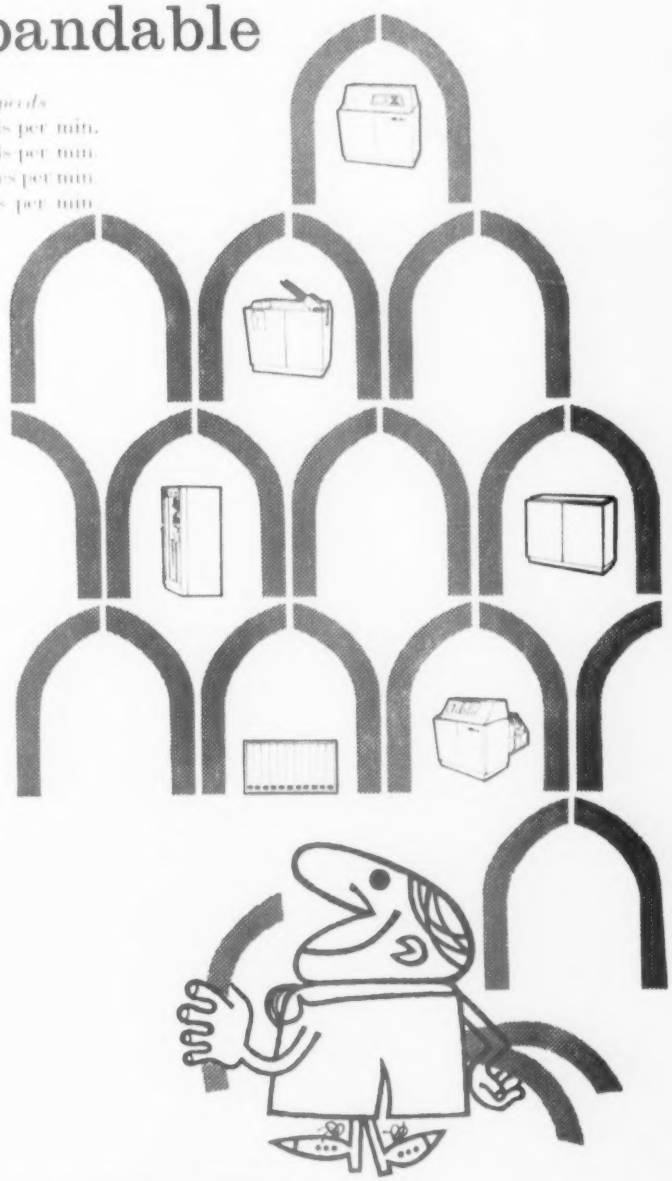
*Magnetic Drum Extension
*Multi-Selector
and Magnetic Tape Units

The Gamma 300 Computer with Drum will bring to the system the advantages of even faster arithmetic units, together with storage of up to 200,000 decimal digits. Should greater capacity be needed up to eight magnetic tape units can be added.

An integrated system is maintained with the addition of each unit to suit requirements. Here then is Data Processing Equipment with the widest possible range of expansion which will be an asset to every organisation with data processing problems.

The first order has been placed for a large installation which is due to be delivered in the early Autumn of 1961.



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